
SECOND ADDENDUM TO CORRECTIVE MEASURES ASSESSMENT FOR THE HELENA LANDFILL HELENA, MONTANA

Prepared For:
Mr. Jeff Towery
Acting Director of Public Works
CITY OF HELENA



Hydrometrics, Inc.[®]

consulting scientists, engineers and contractors

AUGUST 1999

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1.0 INTRODUCTION

2.0 EVALUATION OF

2.1 AIR SPARGING

2.2 GROUNDWATER EXTRACTION

2.2.1 Hydrologic Model

2.2.2 Pilot Study

2.2.3 Aquifer Test Results

2.2.3.1 Water Quality Sampling Results

2.2.3.2 Comparison with

3.0 PROPOSED ALTERNATIVES

3.1 CONCEPTUAL DESIGN

3.2 SCHEDULE

4.0 REFERENCES

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COMMUNITY SERVICES BUREAU

August 1999

TABLE OF CONTENTS

LIST OF TABLES	ii
LIST OF FIGURES	iii
LIST OF APPENDICES	III
1.0 INTRODUCTION	1-1
2.0 EVALUATION OF ALTERNATIVES	2-1
2.1 AIR SPARGING	2-1
2.2 GROUNDWATER EXTRACTION	2-3
2.2.1 Hydrologic Model	2-3
2.2.2 Pilot Study	2-4
<u>2.2.2.1 Aquifer Test Results</u>	<u>2-4</u>
<u>2.2.2.2 Water Quality Sampling Results</u>	<u>2-7</u>
2.2.3 Comparison with Original Hydrologic Modeling	2-8
3.0 PREFERRED ALTERNATIVE – EXTRACTION/IRRIGATION	3-1
3.1 CONCEPTUAL DESIGN	3-1
3.2 SCHEDULE	3-3
4.0 REFERENCES	4-1

LIST OF TABLES

TABLE 2-1. SPARGING CHARACTERISTICS OF LANDFILL	
CONTAMINANTS	2-2
TABLE 2-2. SUMMARY OF AQUIFER TEST RESULTS	2-7
TABLE 2-3. PCE RESULTS FROM EXTRACTION WELL SAMPLING	2-8

LIST OF FIGURES

FIGURE 2-1. LOCATION OF GROUNDWATER EXTRACTION WELL (DWG. NO. 04599A05.DWG).....	2-5
FIGURE 2-2. CROSS SECTION SHOWING SITE STRATIGRAPHY AND WELL COMPLETION (K:\DATA\PROJECT\0054\HLFXSEC2.CDR)	2-6
FIGURE 2-3. CALCULATED CAPTURE ZONE BASED ON RECOVERY TEST RESULTS (K:\DATA\PROJECT\0054\GWMODEL\TDOUT2.CDR)	2-10
FIGURE 3-1. GROUNDWATER EXTRACTION SYSTEM CONCEPTUAL DESIGN (DWG. NO. 04599A06.DWG)	3-2
FIGURE 3-2. PROPOSED GROUNDWATER EXTRACTION SYSTEM IMPLEMENTATION SCHEDULE (H:\FILES\027\0054\ADN2SCD.MPP)	3-4

LIST OF APPENDICES

APPENDIX A	GROUNDWATER SAMPLING DATA
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SECOND ADDENDUM TO CORRECTIVE MEASURES ASSESSMENT FOR THE HELENA LANDFILL HELENA, MONTANA

1.0 INTRODUCTION

This addendum to the Corrective Measures Assessment (CMA) for the Helena Landfill has been prepared to present to the Montana Department of Environmental Quality (MDEQ) and to the public, proposed corrective actions which will be implemented by the City of Helena. These corrective actions are in addition to those already presented and implemented in the original CMA (Hydrometrics, 1995) and the Addendum to the Corrective Measures Assessment for the Helena Landfill (Hydrometrics, 1996). Although these actions have improved water quality, concentrations of tetrachloroethene (PCE) still exceed the maximum contaminant level (MCL) in downgradient compliance wells. Based on discussions with MDEQ and a subsequent technical investigation, the City of Helena proposes the installation of a groundwater extraction system north of the landfill to provide additional water quality improvements downgradient of the landfill and to bring well HL-90-1 into compliance.

Section 2.0 of this addendum provides an evaluation of the remedial alternatives selected for further investigation. This was done at the request of MDEQ since the landfill gas extraction system installed in Centennial Park as part of the addendum to the CMA has not extracted measurable concentrations of PCE, the main groundwater constituent of concern. Section 3.0 describes the proposed additional corrective actions and outlines the proposed schedule for implementation of the corrective actions.

2.0 EVALUATION OF ALTERNATIVES

Six remedial alternatives were presented and developed in the original CMA and two of those have since been implemented as corrective actions. These corrective actions have improved groundwater quality, but not sufficiently to bring PCE levels in the compliance wells (wells HL-90-1, HL-90-2, and MPC-1) below the MCL. Additionally, groundwater quality trends in these wells do not show a decreasing trend in PCE concentrations. Therefore, of the remaining four remedial alternatives investigated in the original CMA but not selected for implementation, two were selected for reevaluation as potential corrective actions. The first is in-situ air sparging with optional vapor extraction (Section 5.3 of the CMA) and the second is groundwater extraction and depending on the season, either aerating it prior to land application or discharging it to the City's POTW (Section 5.5 of the CMA). An evaluation of both alternatives is presented below.

2.1 AIR SPARGING

Air sparging is a technology in which air is injected into the groundwater to volatilize residual contaminants in-situ. Air is injected into the saturated zone through wells installed below the water table and the air bubbles migrate upward through the groundwater to the unsaturated zone. As the air bubbles pass through the contaminated water, volatile organic compounds (VOCs) in the water enter the air and are transported to the unsaturated zone. The air containing the VOCs is then either extracted using a vapor extraction well, or allowed to naturally migrate to the surface and enter the atmosphere.

The effectiveness of the technology is primarily a function of the strippability and/or volatility of the contaminants and the nature and extent of the air pathways in the soil. Table 2-1 lists the VOCs detected in the landfill plume and their Henry's Law constants and vapor pressures. The Henry's Law constant is an indicator of a chemical's strippability (how soluble the gas is in water). As a general rule of thumb, any value greater than 1.0×10^{-5} atm*m³/mol indicates a strippable compound. The vapor pressure is an indicator of a chemical's volatility (how soluble the gas is in air). As a general rule, a vapor pressure

TABLE 2-1. SPARGING CHARACTERISTICS OF LANDFILL CONTAMINANTS

Volatile Organic Compound	Henry's Law Constant (atm*m ³ /mol)	Vapor Pressure (mm Hg)
1,1,1-Trichloroethane	1.5E-02	100
1,1-Dichloroethane	5.9E-03	180
1,2-Dichloropropane	2.8E-03	
Bromodichloromethane	2.5E-03	
Carbon Disulfide	1.8E-02	
Chloroform	4.1E-03	160
Cis-1,2-Dichloroethene	7.4E-03	200
Cis-1,3-Dichloropropene	2.4E-03	
Dichlorodifluoromethane	2.6E-03	608
Methylene Chloride	2.5E-03	349
Tetrachlorethene (PCE)	2.7E-02	14
Trichloroethene (TCE)	1.2E-02	60
Trichlorofluoromethane	2.1E-03	15

greater than 1.0 indicates a volatile compound. All of the listed compounds met the criteria for strippability and volatility indicating that these compounds would be highly amenable to air sparging.

To evaluate the nature and extent of the air pathways, all available well logs for the area were studied. The geology in this area is highly variable in both the saturated and unsaturated zones with layers of fairly permeable materials (sands and gravels) interspersed with layers containing high percentages of fine materials (silt and clay). Air sparging is highly sensitive to variability in the vertical stratigraphy, particularly when a less permeable layer overlies a more permeable layer. In these cases, air bubbles containing contaminants and migrating through the more permeable layer are unlikely to pass through the less permeable layer, but will migrate laterally instead, and in worst cases, actually spread the contamination. Due to the variable stratigraphy in this area, air sparging may not be effective and could produce lateral spreading of the PCE plume.

2.2 GROUNDWATER EXTRACTION

As an alternative to treating the water in-situ, the water can be extracted, treated, and then reinfiltrated back to the aquifer. In the case of the Helena Landfill, extracted water could be sent to the City's wastewater treatment plant or it could be treated prior to use as irrigation water for Bill Roberts Golf Course or Centennial Park. Since the VOCs are easily removed from the extracted water, the feasibility and cost-effectiveness of this alternative depends on the number of wells and pumping rates required to capture the plume leaving the northern boundary of the landfill.

2.2.1 Hydrologic Model

To evaluate the potential effectiveness, associated costs, and regional implications of a groundwater extraction system, a groundwater flow model was developed using MODFLOW. A detailed discussion of the model setup and copies of the model inputs and outputs are included in a report titled "Evaluation of Groundwater Extraction Remediation Alternative at the Helena Landfill," (Hydrometrics, 1999). It was found that the stormwater outfall located north of the landfill creates a groundwater mound and the resulting hydrologic divide causes a large percentage (>95%) of the groundwater beneath the landfill to flow northwest in a narrow flow path just north of the landfill. In this analysis, it required only three wells pumping a total of 65-70 gpm of water to capture this western plume. A 180-day pumping scenario indicated that 75% of the groundwater would be captured if the extraction wells were pumped only during the irrigation season (April through September). Given the low level of contamination in this area and the nature of the contaminants, this would likely be sufficient to reduce concentrations of PCE in compliance well HL-90-1 to below the MCL of 0.005 mg/L. Regional impacts to the groundwater table are expected to be minimal based on the modeling analysis and discussions with golf course personnel who have been pumping this area for an extended period.

This analysis indicates that groundwater extraction could be a very viable option for reducing residual VOCs in the groundwater downgradient of the landfill while providing the City with a source of irrigation water. However, because of the extreme geologic variability in this

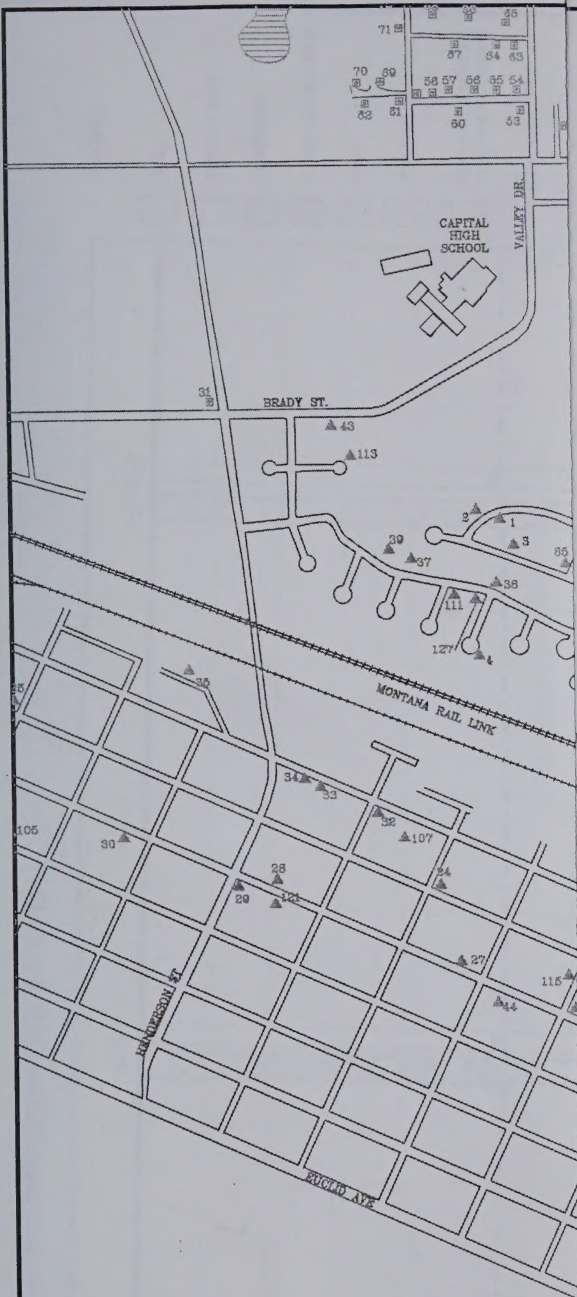
area, a pilot study was conducted to ascertain exact field conditions and to provide information required to complete a full-scale design.

2.2.2 Pilot Study

The pilot study consisted of the installation and development of three groundwater recovery wells, short-term pumping tests (3-4 hours) on these wells, and water quality sampling for volatile organic compounds (VOCs). The field procedures and detailed well completion and aquifer test information is included in the technical report for that investigation (Hydrometrics, 1999). The final locations of the wells, designated HL-99-1, HL-99-2 & HL-99-3, are shown in Figure 2-1 and general stratigraphy and well completion information are shown on Figure 2-2.

2.2.2.1 Aquifer Test Results

Pumping rates, drawdown observations and specific conductance (SC) results for each of the tests are summarized in Table 2-2. All of the collected data were analyzed to determine aquifer transmissivity and hydraulic conductivity. The aquifer test analytical methods and results are described in detail in a separate technical report (Hydrometrics, 1999). The results of the analyses are also summarized in Table 2-2.



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LEGEND

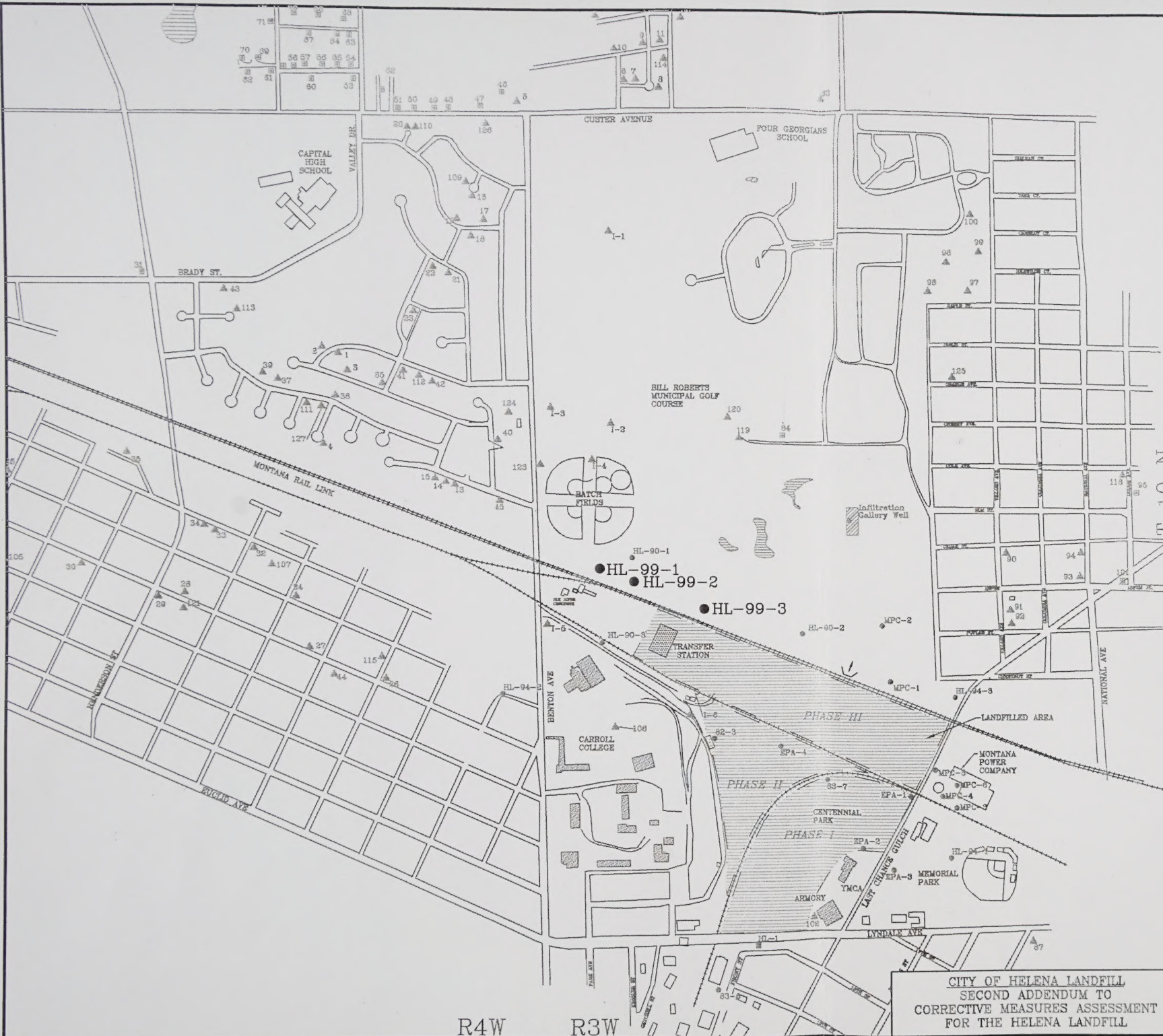
- L-1 ■ PIEZOMETER
- 3-6 ● MONITORING WELL
- 1-5 ▲ IRRIGATION WELL
- 80 □ DOMESTIC WELL
- 2 ● EXTRACTION WELL
- ▨ INFILTRATION GALLERY (GROUNDWATER COLLECTION SYSTEM)
- └ STORM WATER OUTFALL FOR LAST CHANCE GULCH

LOCATION OF GROUNDWATER
EXTRACTION WELLS

FIGURE

2-1





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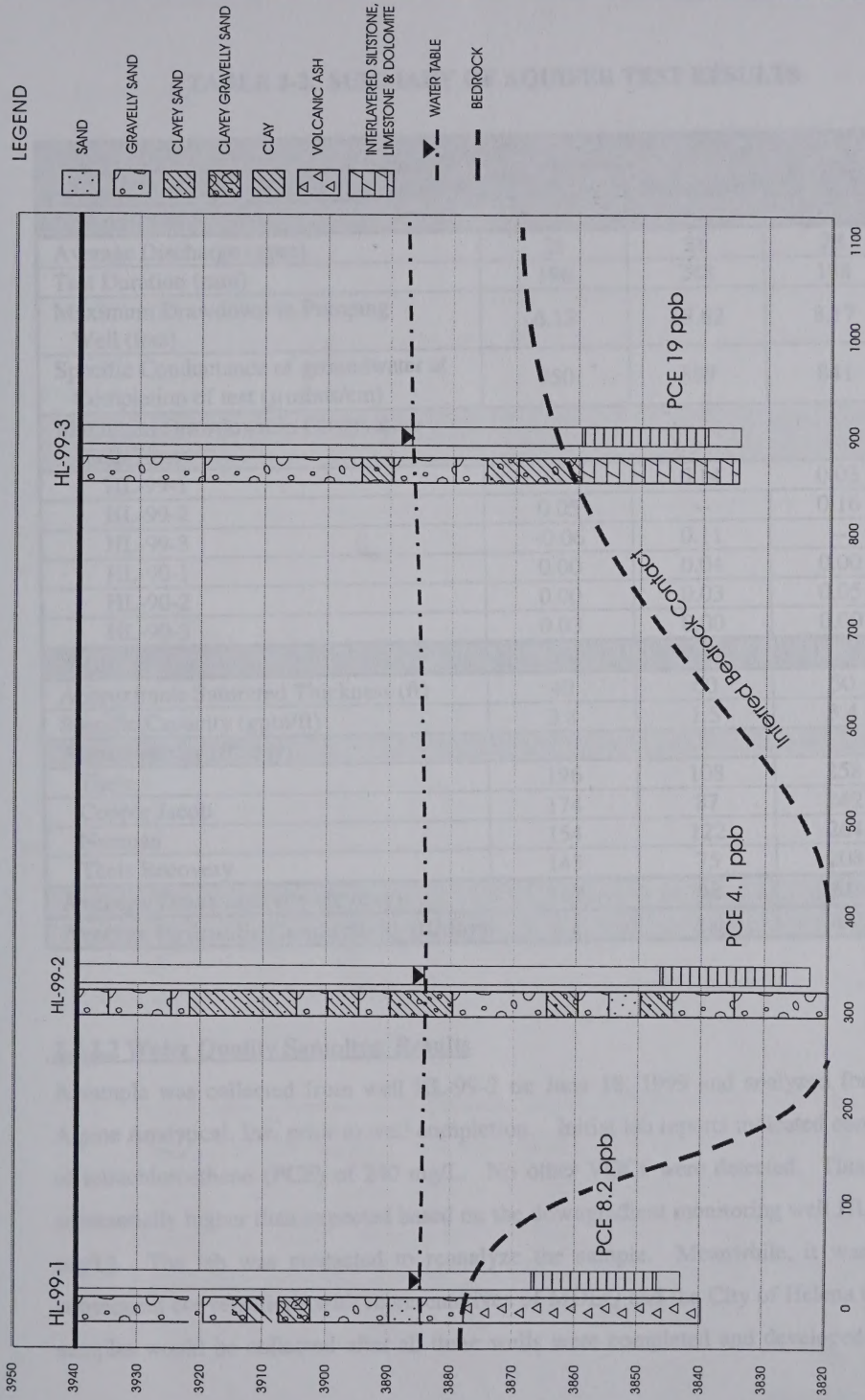
- HL-1 ■ PIEZOMETER
- 33-6 ● MONITORING WELL
- I-6 ▲ IRRIGATION WELL
- 80 □ DOMESTIC WELL
- HL-99-2 ● EXTRACTION WELL
- ▨ INFILTRATION GALLERY (GROUNDWATER COLLECTION SYSTEM)
- ↘ STORM WATER OUTFALL FOR LAST CHANCE GULCH

CITY OF HELENA LANDFILL
SECOND ADDENDUM TO
CORRECTIVE MEASURES ASSESSMENT
FOR THE HELENA LANDFILL

LOCATION OF GROUNDWATER
EXTRACTION WELLS

FIGURE
2-1

HELENA LANDFILL GROUNDWATER RECOVERY TEST WELLS



Note: Reported PCE concentrations are from sampling on 6/28/99.

SECOND ADDENDUM TO CORRECTIVE MEASURES ASSESSMENT FOR THE HELENA LANDFILL HELENA, MONTANA

CROSS SECTION SHOWING SITE STRATIGRAPHY AND WELL COMPLETION DATA

TABLE 2-2. SUMMARY OF AQUIFER TEST RESULTS

PARAMETER	PUMPING WELL		
	HL-99-1	HL-99-2	HL-99-3
Measured Data			
Average Discharge (gpm)	23	28	28
Test Duration (min)	196	248	188
Maximum Drawdown in Pumping Well (feet)	6.13	18.62	8.17
Specific Conductance of groundwater at Completion of test ($\mu\text{mhos/cm}$)	950	899	841
Maximum Drawdown in Observation Wells (feet)			
HL-99-1	--	0.14	0.03
HL-99-2	0.05	--	0.16
HL-99-3	-0.06	0.11	--
HL-90-1	0.00	0.04	0.00
HL-90-2	0.00	0.03	0.05
HL-90-3	0.03	0.00	0.00
Calculated Data			
Approximate Saturated Thickness (ft)	40	60	50
Specific Capacity (gpm/ft)	3.8	1.5	3.4
Transmissivity (ft^2/day)			
Theis	196	108	258
Cooper Jacob	174	87	242
Neuman	154	122	264
Theis Recovery	145	75	208
Average Transmissivity (ft^2/day)	167	98	243
Average Hydraulic Conductivity (ft/day)	4.2	1.6	4.9

2.2.2.2 Water Quality Sampling Results

A sample was collected from well HL-99-2 on June 18, 1999 and analyzed for VOCs by Alpine Analytical, Inc. prior to well completion. Initial lab reports indicated concentrations of tetrachloroethene (PCE) of 240 mg/L. No other VOCs were detected. This result was substantially higher than expected based on the downgradient monitoring well HL-90-1 (<20 mg/L). The lab was contacted to reanalyze the sample. Meanwhile, it was agreed in subsequent conversations with representatives of MDEQ and the City of Helena that a set of samples would be collected after all three wells were completed and developed to confirm

this initial sample and to help determine disposal options during aquifer testing. The second analysis of the water sample indicated a PCE concentration of 4.2 mg/L, well within the expected range. A copy of the analysis is included in Appendix A.

All three wells were sampled on June 28, 1999 after the wells had been completed and developed and again on July 8-12, 1999 during aquifer testing. All six samples were analyzed for VOCs by Energy Laboratories in Billings, Montana. A summary of the PCE results is in Table 2-3. In addition to PCE, detectable concentrations of several other typical landfill contaminants (such as dichlorodifluoromethane, 1,1-dichloroethane, and cis-1,2-dichloroethene) were also measured in the samples. These results were consistent with concentrations of similar compounds previously detected in monitoring well HL-90-1. Copies of these analyses are included in Appendix A.

TABLE 2-3. PCE RESULTS FROM EXTRACTION WELL SAMPLING

SAMPLING EVENT	CONCENTRATIONS OF PCE (mg/L) AND DATE OF SAMPLING		
	HL-99-1	HL-99-2	HL-99-3
Initial Sampling		4.2 (6/18/99)	
Well-Completion Sampling	8.2 (6/28/99)	4.1 (6/28/99)	19 (6/28/99)
During Aquifer Sampling	7.8 (7/12/99)	5.8 (7/8/99)	24 (7/9/99)

2.2.3 Comparison with Original Hydrologic Modeling

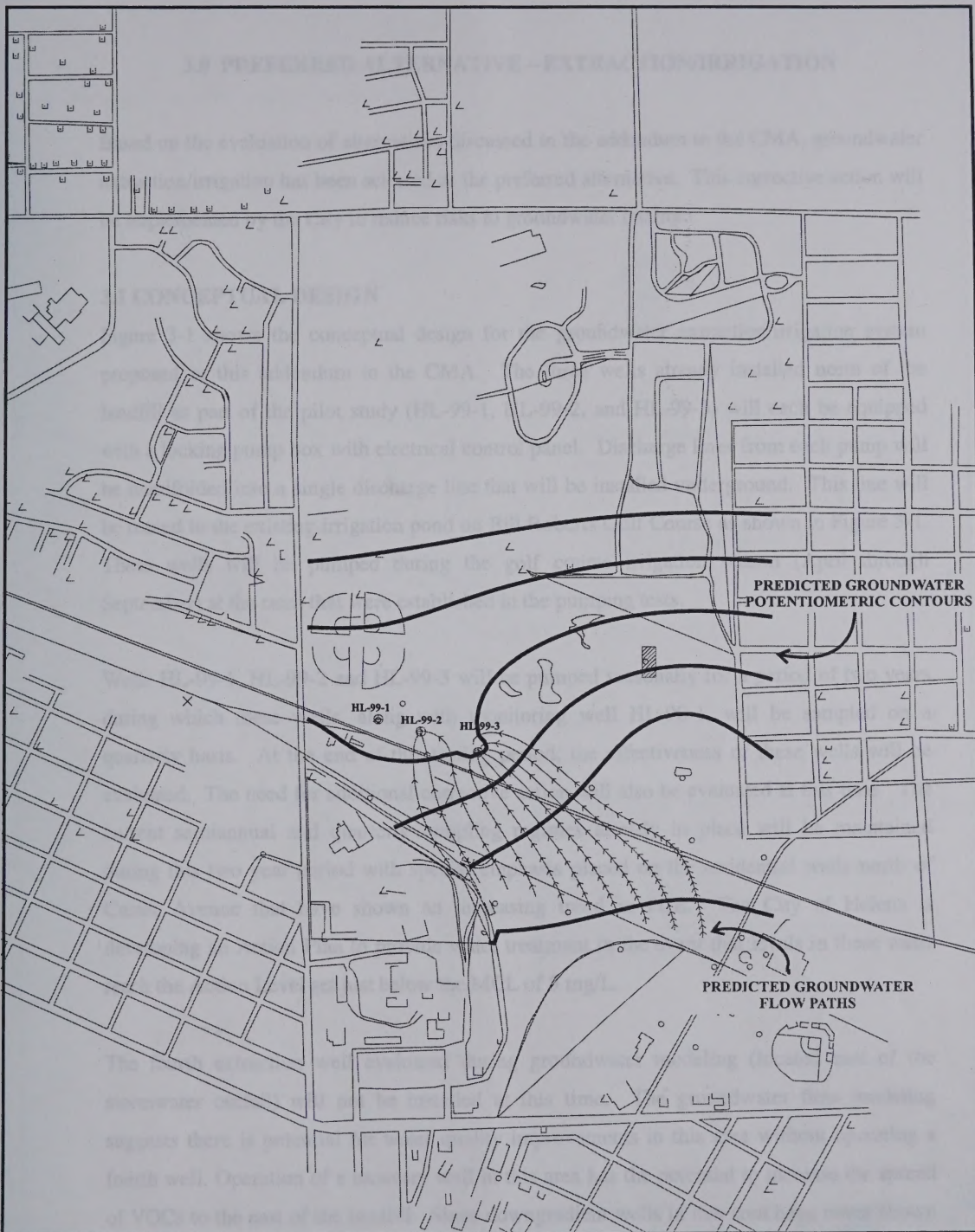
The findings from the field investigation were generally consistent with the initial capture zone analysis with a few exceptions:

- Bedrock was encountered at shallower depths than anticipated at HL-99-1 and HL-99-3. Based on water level and water quality data, the upper portion of the bedrock aquifer at both of these wells is in indirect communication with the alluvial groundwater system and contains similar levels of landfill constituents. A groundwater extraction alternative is still potentially feasible with the observed site conditions.

- Aquifer permeability is somewhat lower than the initial assumptions used to evaluate this alternative. The field data indicate that hydraulic conductivities range from approximately 2 to 5 feet/day in the vicinity of the recovery wells versus 10 to 20 feet/day used in the initial modeling analysis.

Additional calculations were performed to evaluate whether this decrease in permeability significantly alters the potential capture effectiveness of the recovery wells. The capture zones were calculated using an analytical groundwater flow model based on the average hydraulic conductivity from the field investigation. The results, shown in Figure 2-3, indicate an increase in drawdown compared to the original capture scenario. As a result, the capture area is expanded, with the majority of flow from the landfill captured by HL-99-3 and HL-99-2. However, use of well HL-99-1 for groundwater recovery is still recommended to allow for potential uncertainties in the actual capture zone boundaries. Model inputs and outputs are included in the technical report (Hydrometrics, 1999).

The water levels, geology, and VOC concentrations encountered in the field are consistent with the previous analysis and confirm that constituents from the landfill travel northwest along a relatively narrow flow path. The geology, although more variable than originally assumed, is still suitable for a groundwater extraction alternative. The necessary yields predicted by the hydrologic computer model (approximately 20 to 30 gallons per minute) were achieved at each of the recovery wells resulting in significant zones of capture. While the presence of a bedrock groundwater flow system makes it more difficult to accurately characterize the capture zone boundaries, the field observations during testing were generally consistent with the model predictions.



SECOND ADDENDUM TO
CORRECTIVE MEASURES ASSESSMENT
FOR THE HELENA LANDFILL
HELENA, MONTANA

CALCULATED CAPTURE ZONE
BASED ON RECOVERY
TEST RESULTS

FIGURE

2-3

3.0 PREFERRED ALTERNATIVE – EXTRACTION/IRRIGATION

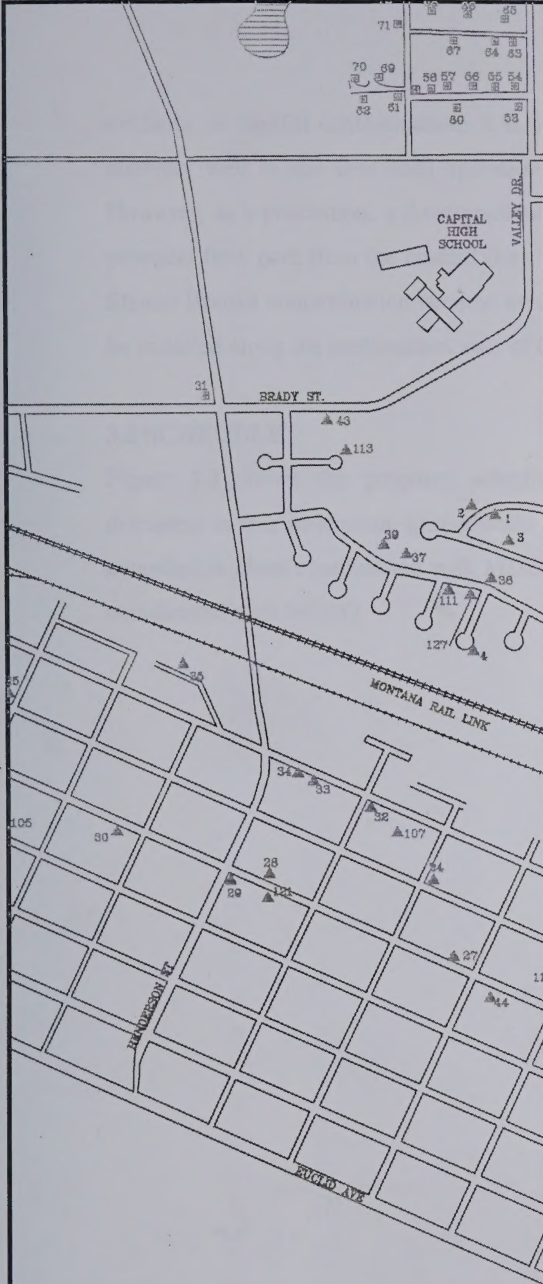
Based on the evaluation of alternatives discussed in the addendum to the CMA, groundwater extraction/irrigation has been selected as the preferred alternative. This corrective action will be implemented by the City to reduce risks to groundwater quality.

3.1 CONCEPTUAL DESIGN

Figure 3-1 shows the conceptual design for the groundwater extraction/irrigation system proposed in this addendum to the CMA. The three wells already installed north of the landfill as part of the pilot study (HL-99-1, HL-99-2, and HL-99-3) will each be equipped with a locking pump box with electrical control panel. Discharge lines from each pump will be manifolded into a single discharge line that will be installed underground. This line will be routed to the existing irrigation pond on Bill Roberts Golf Course as shown in Figure 3-1. These wells will be pumped during the golf course irrigation season (April through September) at the rates that were established in the pumping tests.

Wells HL-99-1, HL-99-2 and HL-99-3 will be pumped seasonally for a period of two years during which these wells, along with monitoring well HL-90-1, will be sampled on a quarterly basis. At the end of this testing period, the effectiveness of these wells will be evaluated. The need for additional corrective action will also be evaluated at this time. The current semiannual and quarterly sampling regimes already in place will be maintained during this two year period with special emphasis placed on the residential wells north of Custer Avenue that have shown an increasing trend in PCE. The City of Helena is developing an Action Plan to provide water treatment in the event that levels in these wells reach the Action Level set just below the MCL of 5 mg/L.

The fourth extraction well evaluated during groundwater modeling (located east of the stormwater outfall) will not be installed at this time. The groundwater flow modeling suggests there is potential for water quality improvements in this area without operating a fourth well. Operation of a recovery well in this area has the potential to increase the spread of VOCs to the east of the landfill. Since downgradient wells in this area have never shown



SCALE
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LEGEND

- 1 ■ PIEZOMETER
- 6 ● MONITORING WELL
- 8 ▲ IRRIGATION WELL
- 80 □ DOMESTIC WELL
- 2 ● EXTRACTION WELL
- ▨ INFILTRATION GALLERY (GROUNDWATER COLLECTION SYSTEM)
- STORM WATER OUTFALL FOR LAST CHANCE GULCH
- PROPOSED GROUNDWATER EXTRACTION DISTRIBUTION MANIFOLD

NDWATER EXTRACTION SYSTEM
CONCEPTUAL DESIGN

FIGURE

3-1



SCALE
(in Feet) 800
0 100 200 300 400 500 600 700 800

LEGEND

- HL-1 ■ PIEZOMETER
- 83-6 ● MONITORING WELL
- I-6 ▲ IRRIGATION WELL
- 80 □ DOMESTIC WELL
- HL-99-2 ● EXTRACTION WELL
- ▨ INFILTRATION GALLERY (GROUNDWATER COLLECTION SYSTEM)
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SECOND ADDENDUM TO
CORRECTIVE MEASURES ASSESSMENT
FOR THE HELENA LANDFILL

GROUNDWATER EXTRACTION SYSTEM
CONCEPTUAL DESIGN

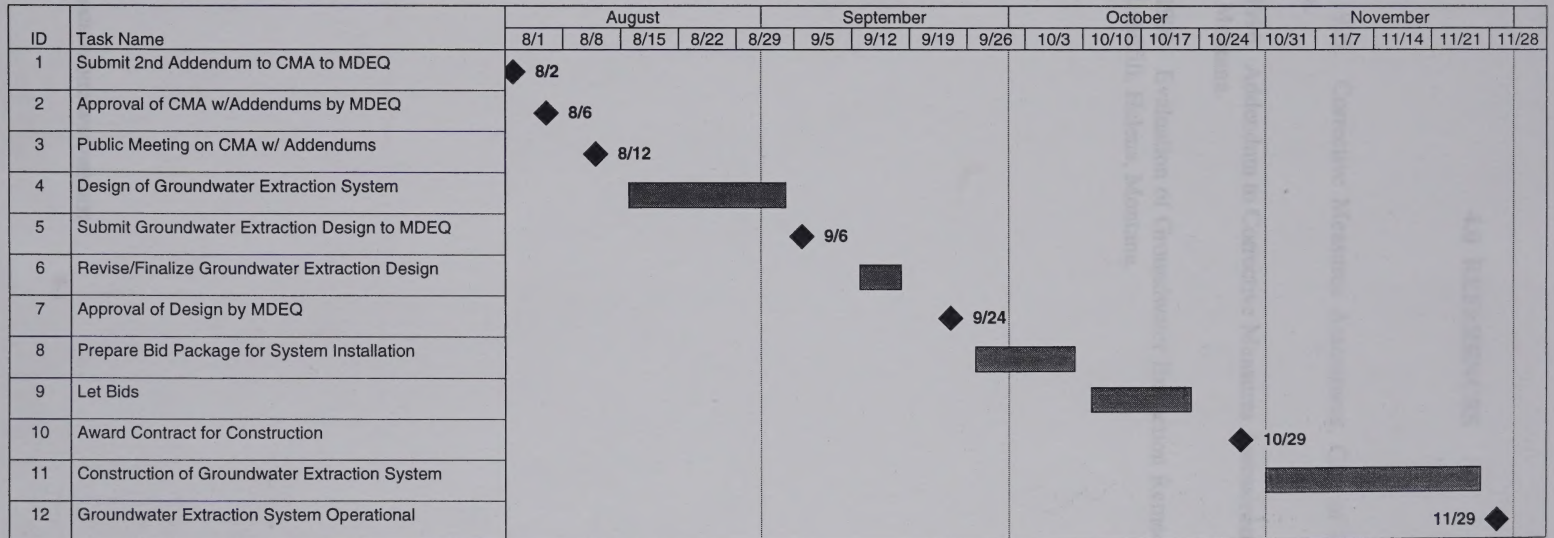
FIGURE
3-1

evidence of landfill contamination; it is preferable to wait before proceeding with a fourth recovery well in this area until operational results are obtained from the first three wells. However, as a precaution, a downgradient well shown by the groundwater model to be in a potential flow path from the landfill (i.e., well 90) will be monitored on a semiannual basis. Should landfill contamination become evident in this well, an additional extraction well may be installed along the northeastern side of the landfill.

3.2 SCHEDULE

Figure 3-2 shows the proposed schedule for implementation of the corrective action discussed in this addendum, groundwater extraction and irrigation. This schedule has been compiled in close coordination with MDEQ. Any changes to this proposed schedule will be coordinated with MDEQ.

FIGURE 3-2. PROPOSED GROUNDWATER EXTRACTION SYSTEM IMPLEMENTATION SCHEDULE



Note: Although the groundwater extraction system will be operational in November, the system will not actually be started until the spring irrigation season in April.

4.0 REFERENCES

- Hydrometrics, 1995. Corrective Measures Assessment, City of Helena Landfill, Helena, Montana.
- Hydrometrics, 1996. Addendum to Corrective Measures Assessment for the Helena Landfill, Helena, Montana.
- Hydrometrics, 1999. Evaluation of Groundwater Extraction Remediation Alternative at the Helena Landfill, Helena, Montana.



Case Narrative

On June 18, 1999, one water sample from a project identified as "other" was received by our laboratory for analysis. The sample was received cool, intact and hand delivered by Joe Brigham. The chain of custody indicated that the sample was to be analyzed by EPA 2 Volatile Organic Compounds.

Results are summarized in the following table:

Should you have any questions regarding this analysis feel free to give us a call at 408-261-4400 or 800-814-2282.

We appreciate the fact that you have chosen us as your analytical lab.

Sincerely yours,

APPENDIX A

GROUNDWATER SAMPLING DATA


Henry Howell
Laboratory Manager



Case Narrative

On June 18, 1999, one water sample from a project identified as "0054" was received by our laboratory for analysis. The samples were received cool, intact and hand delivered by Jodi Bingham. The chain of custody indicated that the samples were to be analyzed by 524.2-Volatile Organic Compounds.

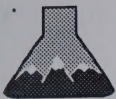
Results are summarized in the following pages.

Should you have any questions regarding this analysis feel free to give us a call at 449-6282 or 800-814-6282.

We appreciate the fact that you have chosen us as your analytical lab.

Sincerely yours,


Harry Howell
Laboratory Manager

**VOLATILE ORGANIC COMPOUNDS****Client:** Hydrometrics**Date Reported:** 21-Jun-99**Sample ID:** HL-99-2**Project ID:** 0054**Chain of Custody #:** Hydro**Site ID:** Helena Landfill**Laboratory ID:** 6G281**Date / Time Sampled:** 18-Jun-99 @ 15:58**Sample Matrix:** Water**Date / Time Received:** 18-Jun-99 @ 16:22**Preservatives:** HCl, Cool**Date / Time Extracted:** NA**Condition:** Intact**Date / Time Analyzed:** 18-Jun-99 @ 16:30

Analytical			Analytical		
Result(ug/L)			Result(ug/L)		
Parameter		PQL (ug/L)	Parameter		PQL (ug/L)
dichlorodifluoromethane	ND	1.0	1,2-dibromoethane	ND	1.0
chloromethane	ND	1.0	chlorobenzene	ND	1.0
vinyl chloride	ND	1.0	1,1,1,2-tetrachloroethane	ND	1.0
bromomethane	ND	1.0	ethylbenzene	ND	1.0
chloroethane	ND	1.0	m, p-xylene	ND	1.0
trichlorofluoromethane	ND	1.0	o-xylene	ND	1.0
1,1-dichloroethene	ND	1.0	styrene	ND	1.0
methylene chloride	ND	1.0	bromoform	ND	1.0
trans-1,2-dichloroethene	ND	1.0	isopropylbenzene	ND	1.0
1,1-dichloroethane	ND	1.0	1,1,2,2-tetrachloroethane	ND	1.0
2,2-dichloropropane	ND	1.0	1,2,3-trichloropropane	ND	1.0
cis-1,2-dichloroethene	ND	1.0	n-propylbenzene	ND	1.0
chloroform	ND	1.0	bromobenzene	ND	1.0
bromochloromethane	ND	1.0	1,3,5-trimethylbenzene	ND	1.0
1,1,1-trichloroethane	ND	1.0	2-chlorotoluene	ND	1.0
1,1-dichloropropene	ND	1.0	4-chlorotoluene	ND	1.0
carbon tetrachloride	ND	1.0	tert-butylbenzene	ND	1.0
1,2-dichloroethane	ND	1.0	1,2,4-trimethylbenzene	ND	1.0
benzene	ND	1.0	sec-butylbenzene	ND	1.0
trichloroethene	ND	1.0	isopropyltoluene	ND	1.0
1,2-dichloropropane	ND	1.0	1,3-dichlorobenzene	ND	1.0
bromodichloromethane	ND	1.0	1,4-dichlorobenzene	ND	1.0
dibromomethane	ND	1.0	butylbenzene	ND	1.0
cis-1,3-dichloropropene	ND	1.0	1,2-dichlorobenzene	ND	1.0
toluene	ND	1.0	1,2-dibromo-3-chloropropane	ND	1.0
trans-1,3-dichloropropene	ND	1.0	1,2,4-trichlorobenzene	ND	1.0
1,1,2-trichloroethane	ND	1.0	hexachlorobutadiene	ND	1.0
1,3-dichloropropane	ND	1.0	naphthalene	ND	1.0
tetrachloroethene	4.3	1.0	1,2,3-trichlorobenzene	ND	1.0
dibromochloromethane	ND	1.0			

Surrogate Standard

Dibromofluoromethane	126%	4-Bromofluorobenzene	113%
1,2-Dichloroethane-d4	68%	Toluene-d8	89%

Comments: ND-Parameter not detected at stated PQL.**References:****METHOD 524.2. MEASUREMENT OF PURGEABLE ORGANIC COMPOUNDS IN WATER**
BY CAPILLARY COLUMN GC/MS, REVISION 3.0 (1989) USEPAReviewed by:

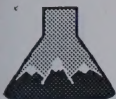
**VOLATILE ORGANIC COMPOUNDS
BLANK****Client: Hydrometrics****Date Reported: 21-Jun-99****Sample ID: BLANK****Project ID: 0054****Site ID: Helena Landfill****Laboratory ID:** Blank
Sample Matrix: Water
Preservatives: HCl, Cool
Condition: Intact**Date / Time Sampled:** NA
Date / Time Received: NA
Date / Time Extracted: NA
Date / Time Analyzed: 18-Jun-99 @ 14:52

Analytical		PQL	Analytical		PQL
Parameter	Result(ug/L)	(ug/L)	Parameter	Result(ug/L)	(ug/L)
dichlorodifluoromethane	ND	1.0	1,2-dibromoethane	ND	1.0
chloromethane	ND	1.0	chlorobenzene	ND	1.0
vinyl chloride	ND	1.0	1,1,1,2-tetrachloroethane	ND	1.0
bromomethane	ND	1.0	ethylbenzene	ND	1.0
chloroethane	ND	1.0	m, p-xylene	ND	1.0
trichlorofluoromethane	ND	1.0	o-xylene	ND	1.0
1,1-dichloroethene	ND	1.0	styrene	ND	1.0
methylene chloride	ND	1.0	bromoform	ND	1.0
trans-1,2-dichloroethene	ND	1.0	isopropylbenzene	ND	1.0
1,1-dichloroethane	ND	1.0	1,1,2,2-tetrachloroethane	ND	1.0
2,2-dichloropropane	ND	1.0	1,2,3-trichloropropane	ND	1.0
cis-1,2-dichloroethene	ND	1.0	n-propylbenzene	ND	1.0
chloroform	ND	1.0	bromobenzene	ND	1.0
bromochloromethane	ND	1.0	1,3,5-trimethylbenzene	ND	1.0
1,1,1-trichloroethane	ND	1.0	2-chlorotoluene	ND	1.0
1,1-dichloropropene	ND	1.0	4-chlorotoluene	ND	1.0
carbon tetrachloride	ND	1.0	tert-butylbenzene	ND	1.0
1,2-dichloroethane	ND	1.0	1,2,4-trimethylbenzene	ND	1.0
benzene	ND	1.0	sec-butylbenzene	ND	1.0
trichloroethene	ND	1.0	isopropyltoluene	ND	1.0
1,2-dichloropropane	ND	1.0	1,3-dichlorobenzene	ND	1.0
bromodichloromethane	ND	1.0	1,4-dichlorobenzene	ND	1.0
dibromomethane	ND	1.0	butylbenzene	ND	1.0
cis-1,3-dichloropropene	ND	1.0	1,2-dichlorobenzene	ND	1.0
toluene	ND	1.0	1,2-dibromo-3-chloropropane	ND	1.0
trans-1,3-dichloropropene	ND	1.0	1,2,4-trichlorobenzene	ND	1.0
1,1,2-trichloroethane	ND	1.0	hexachlorobutadiene	ND	1.0
1,3-dichloropropane	ND	1.0	naphthalene	ND	1.0
tetrachloroethene	ND	1.0	1,2,3-trichlorobenzene	ND	1.0
dibromochloromethane	ND	1.0			

Surrogate Standard

Dibromofluoromethane	105%	4-Bromofluorobenzene	69%
1,2-Dichloroethane-d4	130%	Toluene-d8	100%

Comments: ND-Parameter not detected at stated PQL.**References:****METHOD 524.2. MEASUREMENT OF PURGEABLE ORGANIC COMPOUNDS IN WATER
BY CAPILLARY COLUMN GC/MS, REVISION 3.0 (1989) USEPA**Reviewed by:



Alpine Analytical, Inc.

2814 N. Cooke, Helena, MT 59601

(406)449-6282

VOLATILE ORGANIC COMPOUNDS LAB CONTROL

Client: Hydrometrics
Sample ID: LAB CONTROL
Project ID: 0054
Site ID: Helena Landfill

Date Reported: 21-Jun-99

Laboratory ID: Lab Control
Sample Matrix: Water
Preservatives: HCl, Cool
Condition: Intact

Date / Time Sampled: NA
Date / Time Received: NA
Date / Time Extracted: NA
Date / Time Analyzed: 18-Jun-99 @ 17:19

Parameter	Analytical Result(ug/L)	True Value	% Recovery	Parameter	Analytical Result(ug/L)	True Value	% Recovery
dichlorodifluoromethane	ND	NA	NA	1,2-dibromoethane	ND	NA	NA
chloromethane	ND	NA	NA	chlorobenzene	ND	NA	NA
vinyl chloride	ND	NA	NA	1,1,1,2-tetrachloroethane	ND	NA	NA
bromomethane	ND	NA	NA	ethylbenzene	75	69	109%
chloroethane	ND	NA	NA	m, p-xylene	19	27	70%
trichlorofluoromethane	ND	NA	NA	o-xylene	39	42	93%
1,1-dichloroethene	ND	NA	NA	styrene	ND	NA	NA
methylene chloride	ND	NA	NA	bromoform	ND	NA	NA
trans-1,2-dichloroethene	ND	NA	NA	isopropylbenzene	ND	NA	NA
1,1-dichloroethane	ND	NA	NA	1,1,2,2-tetrachloroethane	ND	NA	NA
2,2-dichloropropane	ND	NA	NA	1,2,3-trichloropropane	ND	NA	NA
cis-1,2-dichloroethene	ND	NA	NA	n-propylbenzene	ND	NA	NA
chloroform	ND	NA	NA	bromobenzene	ND	NA	NA
bromochloromethane	ND	NA	NA	1,3,5-trimethylbenzene	ND	NA	NA
1,1,1-trichloroethane	ND	NA	NA	2-chlorotoluene	ND	NA	NA
1,1-dichloropropene	ND	NA	NA	4-chlorotoluene	ND	NA	NA
carbon tetrachloride	ND	NA	NA	tert-butylbenzene	ND	NA	NA
1,2-dichloroethane	ND	NA	NA	1,2,4-trimethylbenzene	ND	NA	NA
benzene	40	39	103%	sec-butylbenzene	ND	NA	NA
trichloroethene	ND	NA	NA	isopropyltoluene	ND	NA	NA
1,2-dichloropropane	ND	NA	NA	1,3-dichlorobenzene	ND	NA	NA
bromodichloromethane	ND	NA	NA	1,4-dichlorobenzene	ND	NA	NA
dibromomethane	ND	NA	NA	butylbenzene	ND	NA	NA
cis-1,3-dichloropropene	ND	NA	NA	1,2-dichlorobenzene	ND	NA	NA
toluene	ND	NA	NA	1,2-dibromo-3-chloropropane	ND	NA	NA
trans-1,3-dichloropropene	ND	NA	NA	1,2,4-trichlorobenzene	ND	NA	NA
1,1,2-trichloroethane	ND	NA	NA	hexachlorobutadiene	ND	NA	NA
1,3-dichloropropane	ND	NA	NA	naphthalene	ND	NA	NA
tetrachloroethene	ND	NA	NA	1,2,3-trichlorobenzene	ND	NA	NA
dibromochloromethane	ND	NA	NA				

Surrogate Standard

Dibromofluoromethane	70%	4-Bromofluorobenzene	78%
1,2-Dichloroethane-d4	66%	Toluene-d8	72%

Comments: ND-Parameter not detected at stated PQL.

References:

METHOD 524.2. MEASUREMENT OF PURGEABLE ORGANIC COMPOUNDS IN WATER
BY CAPILLARY COLUMN GC/MS, REVISION 3.0 (1989) USEPA

Reviewed by:



Alpine Analytical, Inc.

2814 N. Cooke, Helena, MT 59601

(406)499-6282

VOLATILE ORGANIC COMPOUNDS MATRIX DUPLICATE

Client: Hydrometrics

Date Reported: 21-Jun-99

Sample ID: LAB CONTROL DUPLICATE

Project ID: 0054

Site ID: Helena Landfill

Laboratory ID:	Lab Control-Dup	Date / Time Sampled:	NA
Sample Matrix:	Water	Date / Time Received:	NA
Preservatives:	HCl, Cool	Date / Time Extracted:	NA
Condition:	Intact	Date / Time Analyzed:	18-Jun-99 @ 20:16

Parameter	Analytical Result(ug/L)	Dup. Result	% Relative Difference	Parameter	Analytical Result(ug/L)	Dup. Result	% Relative Difference
dichlorodifluoromethane	ND	NA	NA	1,2-dibromoethane	ND	NA	NA
chloromethane	ND	NA	NA	chlorobenzene	ND	NA	NA
vinyl chloride	ND	NA	NA	1,1,1,2-tetrachloroethane	ND	NA	NA
bromomethane	ND	NA	NA	ethylbenzene	75	71	5%
chloroethane	ND	NA	NA	m, p -xylene	19	15	21%
trichlorofluoromethane	ND	NA	NA	o-xylene	39	34	13%
1,1-dichloroethene	ND	NA	NA	styrene	ND	NA	NA
methylene chloride	ND	NA	NA	bromoform	ND	NA	NA
trans-1,2-dichloroethene	ND	NA	NA	isopropylbenzene	ND	NA	NA
1,1-dichloropropane	ND	NA	NA	1,1,2,2-tetrachloroethane	ND	NA	NA
2,2-dichloropropane	ND	NA	NA	1,2,3-trichloropropane	ND	NA	NA
cis-1,2-dichloroethene	ND	NA	NA	n-propylbenzene	ND	NA	NA
chloroform	ND	NA	NA	bromobenzene	ND	NA	NA
bromochloromethane	ND	NA	NA	1,3,5-trimethylbenzene	ND	NA	NA
1,1,1-trichloroethane	ND	NA	NA	2-chlorotoluene	ND	NA	NA
1,1-dichloropropene	ND	NA	NA	4-chlorotoluene	ND	NA	NA
carbon tetrachloride	ND	NA	NA	tert-butylbenzene	ND	NA	NA
1,2-dichloroethane	ND	NA	NA	1,2,4-trimethylbenzene	ND	NA	NA
benzene	40	42	5%	sec-butylbenzene	ND	NA	NA
trichloroethene	ND	NA	NA	isopropyltoluene	ND	NA	NA
1,2-dichloropropane	ND	NA	NA	1,3-dichlorobenzene	ND	NA	NA
bromodichloromethane	ND	NA	NA	1,4-dichlorobenzene	ND	NA	NA
dibromomethane	ND	NA	NA	butylbenzene	ND	NA	NA
cis-1,3-dichloropropene	ND	NA	NA	1,2-dichlorobenzene	ND	NA	NA
toluene	ND	NA	NA	1,2-dibromo-3-chloropropane	ND	NA	NA
trans-1,3-dichloropropene	ND	NA	NA	1,2,4-trichlorobenzene	ND	NA	NA
1,1,2-trichloroethane	ND	NA	NA	hexachlorobutadiene	ND	NA	NA
1,3-dichloropropane	ND	NA	NA	naphthalene	ND	NA	NA
tetrachloroethene	ND	NA	NA	1,2,3-trichlorobenzene	ND	NA	NA
dibromochloromethane	ND	NA	NA				

Surrogate Standard

Dibromofluoromethane	73%	4-Bromofluorobenzene	99%
1,2-Dichloroethane-d4	98%	Toluene-d8	62%

Comments:

References:

METHOD 524.2. MEASUREMENT OF PURGEABLE ORGANIC COMPOUNDS IN WATER
BY CAPILLARY COLUMN GC/MS, REVISION 3.0 (1989) USEPA

Reviewed by:

2727 Airport Road • Helena, Montana 59601 • (406) 443-4150

[illegible]

STANDARD OPERATING PROCEDURE WATER SAMPLING FORM HF-FORM-430

Consulting Scientists,
Engineers and ContractorsProject Name: CHHLProject Code: 0054Sample Team Member(s): D.S.L.H.Laboratory Used: EnergySite Designation: H1-99-1Sample Code Number: CHHL-9906-100Sample Date: 6/28/99Sample Time: 1540 (military)

If Duplicate Sample Collected, Please Record Below

Duplicate Sample Code #: _____

Duplicate Sample Time: _____

Site Conditions

New Site: ☒ Yes ☐ No Photo taken: ☐ Yes ☒ NoSite Type: DRY surface water process watermonitoring well domestic well adit seep

spring other: _____

Weather Conditions: calm breeze windyno precip. rain snowclear p. cloudy overcastAir Temperature: 20 °C °F

For Groundwater Samples

well volume formula:	$V = (TD-SWL) \times (\text{Dia.})^2$	Comments
	25	
TD (ft):	<u>100'</u>	
SWL (ft):	<u>56.70'</u>	no access/pumping
Casing Diameter (I.D.):	<u>6"</u>	MP-Top
Water Volume (V) (gal):	<u>62</u>	of steel
x 3=(gal.)	<u>187</u>	
Actual Vol. Removed (gal.)	<u>187</u>	
Water Level Recovery:	<u>slow</u> moderate rapid	

For Surface Water Samples

Flow Method:	Marsh McBirney	Volumetric	Flume	Weir	Estimate
Other Flow or Description:	_____				
Flow:	gpm	cfs	Staff Gage:	_____	

Field Parameter Stabilization

Time (military)	Oxidation Reduction Potential (mV)	Dissolved Oxygen (mg/l)	pH	S.C. (µmhos/cm)	Turbidity (n.t.u.)	Temperature (°C)	Additional Parameters or Notes

Turbidity: ☐ clear ☒ moderate ☐ very slightSample Method: ☒ grab composite ☒ pump ☒ bailer other(describe) 4" sub pump 725p. Bailer

Field Parameters

	Sample	Duplicate
ORP (mV)		
DO (mg/l)		
pH		
SC (µmhos/cm)		
Turbidity (ntu)		
H ₂ O Tmp. (°C)		
Color	<u>TAN</u>	
Other:		

Bottles Collected

Quantity	Size	Filter or Unfilt.	Preservative	Parameter	Additional Notes
<u>2</u>	<u>40</u> ml	F or (UF)	<u>HCL</u>	<u>DOC</u>	
	ml	F or UF			
	ml	F or UF			
	ml	F or UF			
	ml	F or UF			
	ml	F or UF			
	ml	F or UF			
	ml	F or UF			
	ml	F or UF			

Comments: Sample collected with D.S.P. BailerSWL Drilled approx 20' @ 8.5 gpm Pumped 22 minsSample Team Member Signature: Dal St

Page _____ of _____

STANDARD OPERATING PROCEDURE WATER SAMPLING FORM HF-FORM-430

Consulting Scientists,
Engineers and ContractorsProject Name: CHLProject Code: 0054Sample Team Member(s): D.S. & L.Laboratory Used: EnergySite Designation: HL-99-2Sample Code Number: CHL-9906-101Sample Date: 6/28/99Sample Time: 1635 (military)

If Duplicate Sample Collected,
Please Record Below

Duplicate Sample Code #: _____

Duplicate Sample Time: _____

Site ConditionsNew Site: ☒ Yes ☐ No Photo taken: Yes ☒ NoSite Type: DRY surface water process watermonitoring well domestic well adit seep

spring other: _____

Weather Conditions: calm breeze windyno precip. rain snowclear p. cloudy overcastAir Temperature: 20 °C °FFor Groundwater Samples

well volume formula:	$V = (TD-SWL) \times (Dia.^2) / 25$	Comments
TD (ft):	<u>120</u>	
SWL (ft):	<u>57.75</u>	no access/pumping
Casing Diameter (I.D.):	<u>6"</u>	mp-top of steel
Water Volume (V) (gal):	<u>89</u>	
x 3=(gal.)	<u>269</u>	
Actual Vol. Removed (gal.):	<u>270</u>	
Water Level Recovery:	slow <u>(moderate)</u> rapid	

For Surface Water SamplesFlow Method: Marsh McBirney Volumetric Flume Weir Estimate

Other Flow or Description: _____

Flow: _____ gpm cfs Staff Gage: _____

Field Parameter Stabilization

Time (military)	Oxidation Reduction Potential (mV)	Dissolved Oxygen (mg/l)	pH	S.C. (µmhos/cm)	Turbidity (n.t.u.)	Temperature (°C)	Additional Parameters or Notes

Turbidity: clear (moderate) slight verySample Method: (grab) composite (pump) (bailer) other4" Sub pump / Disp.Field Parameters

	Sample	Duplicate
ORP (mV)		
DO (mg/l)		
pH		
SC (µmhos/cm)		
Turbidity (ntu)		
H ₂ O Temp. (°C)		
Color	<u>Light Orange</u>	
Other:		

Bottles Collected

Quantity	Size	Filter or Unfilt.	Preservative	Parameter	Additional Notes
<u>2</u>	<u>40</u> ml	F or (UF)	<u>HCL</u>	<u>DOC</u>	
	ml	F or UF			
	ml	F or UF			
	ml	F or UF			
	ml	F or UF			
	ml	F or UF			
	ml	F or UF			
	ml	F or UF			
	ml	F or UF			
	ml	F or UF			

Comments: Sample collected with Disp. BailerSW dropped approx 5.0' @ 7.5 gpm 30 mins of pumpingSample Team Member Signature: [Signature]

Page _____ of _____

STANDARD OPERATING PROCEDURE WATER SAMPLING FORM HF-FORM-430

Consulting Scientists,
Engineers and ContractorsProject Name: CHHLProject Code: 0054Sample Team Member(s): PS. TchLaboratory Used: EnergySite Designation: HL-99-3
HL-9906-102RSample Code Number: CHHL-9906-102Sample Date: 6/28/99Sample Time: 1730 (military)**For Groundwater Samples**

If Duplicate Sample Collected,
Please Record Below

Duplicate Sample Code #:

Duplicate Sample Time:

Site ConditionsNew Site: ☒ Yes ☐ No Photo taken: ☐ Yes ☒ NoSite Type: DRY surface water process watermonitoring well domestic well adit seep

spring other:

Weather Conditions: calm breeze windyno precip. rain snowclear b. cloudy overcastAir Temperature: 20 °C °Fwell volume formula: $V = (TD-SWL) \times (\text{Dia.}^2) / 25$

Comments

TD (ft): 100'SWL (ft): 53.15'

no access/pumping

Casing Diameter (I.D.): 6"

MP-Top of

Water Volume (V) (gal): 67

steel

x 3=(gal.) 201Actual Vol. Removed (gal.) 201Water Level Recovery: slow moderate rapid**For Surface Water Samples**Flow Method: Marsh McBirney Volumetric Flume Weir Estimate

Other Flow or Description:

Flow: gpm cfs Staff Gage:

Field Parameter Stabilization

Time (military)	Oxidation Reduction Potential (mV)	Dissolved Oxygen (mg/l)	pH	S.C. (µmhos/cm)	Turbidity (n.t.u.)	Temperature (°C)	Additional Parameters or Notes

Turbidity: (circle) clear slight moderate verySample Method: grab composite pump bailer other
(describe) 4" Sub Pump / Disp**Field Parameters**

Sample	Duplicate
ORP (mV)	
DO (mg/l)	
pH	
SC (µmhos/cm)	
Turbidity (ntu)	
H ₂ O Tmp. (°C)	
Color	<u>lt. Orange</u>
Other:	

Quantity	Size	Filter or Unfilt.	Preservative	Parameter	Additional Notes
<u>2</u>	<u>40 ml</u>	<u>F or UF</u>	<u>HCL</u>	<u>DOC</u>	
	ml	F or UF			
	ml	F or UF			
	ml	F or UF			
	ml	F or UF			
	ml	F or UF			
	ml	F or UF			
	ml	F or UF			
	ml	F or UF			
	ml	F or UF			

Bottles CollectedComments: Sample collected with Disp Bailer
SWL Dropped Approx. 40' @ 8 gpm for 25 minSample Team Member Signature: PS. Tch

Page of

EPA METHOD 8260AClient: **Hydrometrics**
Sample ID: **CHHL-9906-100**
Project Info: **PROJ. #0054, HELENA LANDFILL**
Lab ID: **001-99-54235**
Matrix: **WATER**Date Reported: **07/05/99**
Date Sampled: **6/28/99 15:40**
Date Received: **06/30/99**
Date Analyzed: **7/1/99 23:00**

HL-99-1

C.A.S. #	TARGET COMPOUNDS	CONCENTRATION	LIMIT OF
		($\mu\text{g/L}$)	QUANTITATION($\mu\text{g/L}$)
67-64-1	Acetone	904D	20
107-13-1	Acrylonitrile	ND	20
71-43-2	Benzene	ND	1.0
74-97-5	Bromochloromethane	ND	1.0
75-27-4	Bromodichloromethane	ND	1.0
75-25-2	Bromoform	ND	1.0
74-83-9	Bromomethane	ND	1.0
75-15-0	Carbon disulfide	ND	1.0
56-23-5	Carbon tetrachloride	ND	1.0
108-90-7	Chlorobenzene	ND	1.0
124-48-1	Chlorodibromomethane	ND	1.0
75-00-3	Chloroethane	ND	1.0
67-66-3	Chloroform	2.8	1.0
74-87-3	Chloromethane	ND	1.0
96-12-8	1,2-Dibromo-3-chloropropane	ND	1.0
106-93-4	1,2-Dibromoethane	ND	1.0
74-95-3	Dibromomethane	ND	1.0
95-50-1	1,2-Dichlorobenzene	ND	1.0
106-46-7	1,4-Dichlorobenzene	ND	1.0
110-57-6	trans-1,4-Dichloro-2-butene	ND	2.0
75-71-8	Dichlorodifluoromethane	1.7	1.0
75-34-3	1,1-Dichloroethane	1.5	1.0
107-06-2	1,2-Dichloroethane	ND	1.0
75-35-4	1,1-Dichloroethene	ND	1.0
156-59-2	cis-1,2-Dichloroethene	1.1	1.0
156-60-5	trans-1,2-Dichloroethene	ND	1.0
78-87-5	1,2-Dichloropropane	ND	1.0
10061-01-5	cis-1,3-Dichloropropene	ND	1.0
10061-02-6	trans-1,3-Dichloropropene	ND	1.0
100-41-4	Ethylbenzene	ND	1.0
591-78-6	2-Hexanone	ND	20
74-88-4	Iodomethane	ND	1.0
78-93-3	Methyl ethyl ketone	(19)J	20
108-10-1	Methyl isobutyl ketone	ND	20
75-09-2	Methylene chloride	(0.31)J	1.0
100-42-5	Styrene	ND	1.0
630-20-6	1,1,1,2-Tetrachloroethane	ND	1.0
79-34-5	1,1,2,2-Tetrachloroethane	ND	1.0
127-18-4	Tetrachloroethene	8.2	1.0
108-88-3	Toluene	ND	1.0
71-55-6	1,1,1-Trichloroethane	(0.99)J	1.0
79-00-5	1,1,2-Trichloroethane	ND	1.0
79-01-6	Trichloroethene	(0.91)J	1.0
75-69-4	Trichlorofluoromethane	(0.45)J	1.0
96-18-4	1,2,3-Trichloropropane	ND	1.0

EPA METHOD 8260A(Continued)

Client: **Hydrometrics**
Sample ID: **CHHL-9906-100**

Date Reported: **7/5/99**
Lab ID: **001-99-54235**

C.A.S. #	TARGET COMPOUNDS	CONCENTRATION (µg/L)	LIMIT OF QUANTITATION(µg/L)
108-05-4	Vinyl acetate	ND	1.0
75-01-4	Vinyl chloride	ND	1.0
108383/106423	m+p-Xylenes	ND	1.0
95-47-6	o-Xylene	ND	1.0

ND= Indicates compound was analyzed for but not detected.

D= Value was derived from a 10 times dilution.

J= Estimated value. Present, but less than the limit of quantitation.

Runtime Quality Assurance Report

SYSTEM MONITORING COMPOUNDS	CONCENTRATION(µg/L)		PERCENT	ACCEPTANCE RANGE
	ADDED	MEASURED	RECOVERY	
1,2-Dichloroethane d4	10	11.8	118	80-120
Toluene d8	10	10.3	103	80-120
p-Bromofluorobenzene	10	9.32	93	80-120

REPORT COMMENTS: None

Analyst: Reviewing Supervisor: /chem/5971A.lva070199.b/jul011501015.d

EPA METHOD 8260A

Client: **Hydrometrics**
Sample ID: **CHHL-9906-101**
Project Info: **PROJ. #0054, HELENA LANDFILL**
Lab ID: **002-99-54235**
Matrix: **WATER**

HL-99-2

Date Reported: **07/05/99**
Date Sampled: **6/28/99 16:35**
Date Received: **06/30/99**
Date Analyzed: **7/1/99 19:23**

C.A.S. #	TARGET COMPOUNDS	CONCENTRATION	LIMIT OF
		($\mu\text{g/L}$)	QUANTITATION($\mu\text{g/L}$)
67-64-1	Acetone	(16)J	20
107-13-1	Acrylonitrile	ND	20
71-43-2	Benzene	ND	1.0
74-97-5	Bromochloromethane	ND	1.0
75-27-4	Bromodichloromethane	ND	1.0
75-25-2	Bromoform	ND	1.0
74-83-9	Bromomethane	ND	1.0
75-15-0	Carbon disulfide	ND	1.0
56-23-5	Carbon tetrachloride	ND	1.0
108-90-7	Chlorobenzene	ND	1.0
124-48-1	Chlorodibromomethane	ND	1.0
75-00-3	Chloroethane	ND	1.0
67-66-3	Chloroform	1.6	1.0
74-87-3	Chloromethane	ND	1.0
96-12-8	1,2-Dibromo-3-chloropropane	ND	1.0
106-93-4	1,2-Dibromoethane	ND	1.0
74-95-3	Dibromomethane	ND	1.0
95-50-1	1,2-Dichlorobenzene	ND	1.0
106-46-7	1,4-Dichlorobenzene	ND	1.0
110-57-6	trans-1,4-Dichloro-2-butene	ND	2.0
75-71-8	Dichlorodifluoromethane	(0.82)J	1.0
75-34-3	1,1-Dichloroethane	1.2	1.0
107-06-2	1,2-Dichloroethane	ND	1.0
75-35-4	1,1-Dichloroethene	ND	1.0
156-59-2	cis-1,2-Dichloroethene	(0.32)J	1.0
156-60-5	trans-1,2-Dichloroethene	ND	1.0
78-87-5	1,2-Dichloropropane	ND	1.0
10061-01-5	cis-1,3-Dichloropropene	ND	1.0
10061-02-6	trans-1,3-Dichloropropene	ND	1.0
100-41-4	Ethylbenzene	ND	1.0
591-78-6	2-Hexanone	ND	20
74-88-4	Iodomethane	ND	1.0
78-93-3	Methyl ethyl ketone	ND	20
108-10-1	Methyl isobutyl ketone	ND	20
75-09-2	Methylene chloride	(0.89)J	1.0
100-42-5	Styrene	ND	1.0
630-20-6	1,1,1,2-Tetrachloroethane	ND	1.0
79-34-5	1,1,2,2-Tetrachloroethane	ND	1.0
127-18-4	Tetrachloroethene	4.1	1.0
108-88-3	Toluene	ND	1.0
71-55-6	1,1,1-Trichloroethane	(0.59)J	1.0
79-00-5	1,1,2-Trichloroethane	ND	1.0
79-01-6	Trichloroethene	(0.48)J	1.0
75-69-4	Trichlorofluoromethane	(0.21)J	1.0
96-18-4	1,2,3-Trichloropropane	ND	1.0

EPA METHOD 8260A(Continued)

Client: **Hydrometrics**
Sample ID: **CHHL-9906-101**

Date Reported: **7/5/99**
Lab ID: **002-99-54235**

C.A.S. #	TARGET COMPOUNDS	CONCENTRATION (µg/L)	LIMIT OF QUANTITATION(µg/L)
108-05-4	Vinyl acetate	ND	1.0
75-01-4	Vinyl chloride	ND	1.0
108383/106423	m+p-Xylenes	ND	1.0
95-47-6	o-Xylene	ND	1.0

ND= Indicates compound was analyzed for but not detected.

J= Estimated value. Present, but less than the limit of quantitation.

Runtime Quality Assurance Report

SYSTEM MONITORING COMPOUNDS	CONCENTRATION(µg/L)		PERCENT	ACCEPTANCE RANGE
	ADDED	MEASURED	RECOVERY	
1,2-Dichloroethane d4	10	10.8	108	80-120
Toluene d8	10	10.2	102	80-120
p-Bromofluorobenzene	10	9.04	90	80-120

REPORT COMMENTS: None

Analyst: C Reviewing Supervisor: MD /chem/5971A.Iva070199.b/jul010901009.d

EPA METHOD 8260AClient: **Hydrometrics**
Sample ID: **CHHL-9906-102**
Project Info: **PROJ. #0054, HELENA LANDFILL**
Lab ID: **003-99-54235**
Matrix: **WATER**Date Reported: **07/05/99**
Date Sampled: **6/28/99 17:30**
Date Received: **06/30/99**
Date Analyzed: **7/1/99 23:34**

HL-993

C.A.S. #	TARGET COMPOUNDS	CONCENTRATION	LIMIT OF
		($\mu\text{g/L}$)	QUANTITATION($\mu\text{g/L}$)
67-64-1	Acetone	(18)J	20
107-13-1	Acrylonitrile	ND	20
71-43-2	Benzene	(0.18)J	1.0
74-97-5	Bromochloromethane	ND	1.0
75-27-4	Bromodichloromethane	ND	1.0
75-25-2	Bromoform	ND	1.0
74-83-9	Bromomethane	ND	1.0
75-15-0	Carbon disulfide	ND	1.0
56-23-5	Carbon tetrachloride	ND	1.0
108-90-7	Chlorobenzene	ND	1.0
124-48-1	Chlorodibromomethane	ND	1.0
75-00-3	Chloroethane	ND	1.0
67-66-3	Chloroform	1.7	1.0
74-87-3	Chloromethane	ND	1.0
96-12-8	1,2-Dibromo-3-chloropropane	ND	1.0
106-93-4	1,2-Dibromoethane	ND	1.0
74-95-3	Dibromomethane	ND	1.0
95-50-1	1,2-Dichlorobenzene	ND	1.0
106-46-7	1,4-Dichlorobenzene	ND	1.0
110-57-6	trans-1,4-Dichloro-2-butene	ND	2.0
75-71-8	Dichlorodifluoromethane	5.7	1.0
75-34-3	1,1-Dichloroethane	4.3	1.0
107-06-2	1,2-Dichloroethane	ND	1.0
75-35-4	1,1-Dichloroethene	(0.24)J	1.0
156-59-2	cis-1,2-Dichloroethene	(0.37)J	1.0
156-60-5	trans-1,2-Dichloroethene	ND	1.0
78-87-5	1,2-Dichloropropane	ND	1.0
10061-01-5	cis-1,3-Dichloropropene	ND	1.0
10061-02-6	trans-1,3-Dichloropropene	ND	1.0
100-41-4	Ethylbenzene	ND	1.0
591-78-6	2-Hexanone	ND	20
74-88-4	Iodomethane	ND	1.0
78-93-3	Methyl ethyl ketone	ND	20
108-10-1	Methyl isobutyl ketone	ND	20
75-09-2	Methylene chloride	7.2	1.0
100-42-5	Styrene	(0.39)J	1.0
630-20-6	1,1,1,2-Tetrachloroethane	ND	1.0
79-34-5	1,1,2,2-Tetrachloroethane	ND	1.0
127-18-4	Tetrachloroethene	19	1.0
108-88-3	Toluene	ND	1.0
71-55-6	1,1,1-Trichloroethane	3.2	1.0
79-00-5	1,1,2-Trichloroethane	ND	1.0
79-01-6	Trichloroethene	1.9	1.0
75-69-4	Trichlorofluoromethane	3.2	1.0
96-18-4	1,2,3-Trichloropropane	ND	1.0

EPA METHOD 8260A(Continued)

Client: **Hydrometrics**
Sample ID: **CHHL-9906-102**

Date Reported: **7/5/99**
Lab ID: **003-99-54235**

C.A.S. #	TARGET COMPOUNDS	CONCENTRATION ($\mu\text{g/L}$)	LIMIT OF QUANTITATION($\mu\text{g/L}$)
108-05-4	Vinyl acetate	ND	1.0
75-01-4	Vinyl chloride	ND	1.0
108383/106423	m+p-Xylenes	ND	1.0
95-47-6	o-Xylene	ND	1.0

ND= Indicates compound was analyzed for but not detected.

J= Estimated value. Present, but less than the limit of quantitation.

Runtime Quality Assurance Report

SYSTEM MONITORING COMPOUNDS	CONCENTRATION($\mu\text{g/L}$)		PERCENT RECOVERY	ACCEPTANCE RANGE
	ADDED	MEASURED		
1,2-Dichloroethane d4	10	11.5	115	80-120
Toluene d8	10	10.2	102	80-120
p-Bromofluorobenzene	10	9.16	92	80-120

REPORT COMMENTS: None

Analyst: SP Reviewing Supervisor: MB /chem/5971A.i/va070199.b/jul011601016.d

QUALITY ASSURANCE REPORT FOR EPA METHOD 8260A: METHOD BLANK

Sample ID: Quality Assurance Method Blank
 Matrix: WATER
 Extract Method: EPA 5030

Date Reported: 07/05/99
 Date Analyzed: 7/1/99 18:33

C.A.S. #	TARGET COMPOUNDS	CONCENTRATION ($\mu\text{g/L}$)	LIMIT OF QUANTITATION($\mu\text{g/L}$)
67-64-1	Acetone	ND	20
107-13-1	Acrylonitrile	ND	20
71-43-2	Benzene	ND	1.0
74-97-5	Bromochloromethane	ND	1.0
75-27-4	Bromodichloromethane	ND	1.0
75-25-2	Bromoform	ND	1.0
74-83-9	Bromomethane	ND	1.0
75-15-0	Carbon disulfide	ND	1.0
56-23-5	Carbon tetrachloride	ND	1.0
108-90-7	Chlorobenzene	ND	1.0
124-48-1	Chlorodibromomethane	ND	1.0
75-00-3	Chloroethane	ND	1.0
67-66-3	Chloroform	ND	1.0
74-87-3	Chloromethane	ND	1.0
96-12-8	1,2-Dibromo-3-chloropropane	ND	1.0
106-93-4	1,2-Dibromoethane	ND	1.0
74-95-3	Dibromomethane	ND	1.0
95-50-1	1,2-Dichlorobenzene	ND	1.0
106-46-7	1,4-Dichlorobenzene	ND	1.0
110-57-6	trans-1,4-Dichloro-2-butene	ND	2.0
75-71-8	Dichlorodifluoromethane	ND	1.0
75-34-3	1,1-Dichloroethane	ND	1.0
107-06-2	1,2-Dichloroethane	ND	1.0
75-35-4	1,1-Dichloroethene	ND	1.0
156-59-2	cis-1,2-Dichloroethene	ND	1.0
156-60-5	trans-1,2-Dichloroethene	ND	1.0
78-87-5	1,2-Dichloropropane	ND	1.0
10061-01-5	cis-1,3-Dichloropropene	ND	1.0
10061-02-6	trans-1,3-Dichloropropene	ND	1.0
100-41-4	Ethylbenzene	ND	1.0
591-78-6	2-Hexanone	ND	20
74-88-4	Iodomethane	ND	1.0
78-93-3	Methyl ethyl ketone	ND	20
108-10-1	Methyl isobutyl ketone	ND	20
75-09-2	Methylene chloride	ND	1.0
100-42-5	Styrene	ND	1.0
630-20-6	1,1,1,2-Tetrachloroethane	ND	1.0
79-34-5	1,1,2,2-Tetrachloroethane	ND	1.0
127-18-4	Tetrachloroethene	ND	1.0
108-88-3	Toluene	ND	1.0
71-55-6	1,1,1-Trichloroethane	ND	1.0
79-00-5	1,1,2-Trichloroethane	ND	1.0
79-01-6	Trichloroethene	ND	1.0
75-69-4	Trichlorofluoromethane	ND	1.0
96-18-4	1,2,3-Trichloropropane	ND	1.0

QUALITY ASSURANCE REPORT FOR EPA METHOD 8260A: METHOD BLANK (Continued)

Sample ID: Quality Assurance Method Blank
Matrix: WATER

Date Reported: 07/05/99
Date Analyzed:

C.A.S. #	TARGET COMPOUNDS	CONCENTRATION ($\mu\text{g/L}$)	LIMIT OF QUANTITATION($\mu\text{g/L}$)
108-05-4	Vinyl acetate	ND	1.0
75-01-4	Vinyl chloride	ND	1.0
108383/106423	m+p-Xylenes	ND	1.0
95-47-6	o-Xylene	ND	1.0

ND= Indicates compound was analyzed for but not detected.

Runtime Quality Assurance Report

SYSTEM MONITORING COMPOUNDS	CONCENTRATION($\mu\text{g/L}$)		PERCENT	ACCEPTANCE RANGE
	ADDED	MEASURED	RECOVERY	
1,2-Dichloroethane d4	10	11.5	115	80-120
Toluene d8	10	9.98	100	80-120
p-Bromofluorobenzene	10	9.61	96	80-120

REPORT COMMENTS: None

Analyst: 

Reviewing Supervisor: 

/chem/5971A:\va070199.b\jul010801008.d

QUALITY ASSURANCE REPORT FOR EPA METHOD 8260A: METHOD BLANK

Sample ID: Quality Assurance Method Blank
 Matrix: WATER
 Extract Method: EPA 5030

Date Reported: 07/05/99
 Date Analyzed: 7/1/99 22:25

C.A.S. #	TARGET COMPOUNDS	CONCENTRATION ($\mu\text{g/L}$)	LIMIT OF QUANTITATION($\mu\text{g/L}$)
67-64-1	Acetone	ND	20
107-13-1	Acrylonitrile	ND	20
71-43-2	Benzene	ND	1.0
74-97-5	Bromochloromethane	ND	1.0
75-27-4	Bromodichloromethane	ND	1.0
75-25-2	Bromoform	ND	1.0
74-83-9	Bromomethane	ND	1.0
75-15-0	Carbon disulfide	ND	1.0
56-23-5	Carbon tetrachloride	ND	1.0
108-90-7	Chlorobenzene	ND	1.0
124-48-1	Chlorodibromomethane	ND	1.0
75-00-3	Chloroethane	ND	1.0
67-66-3	Chloroform	ND	1.0
74-87-3	Chloromethane	ND	1.0
96-12-8	1,2-Dibromo-3-chloropropane	ND	1.0
106-93-4	1,2-Dibromoethane	ND	1.0
74-95-3	Dibromomethane	ND	1.0
95-50-1	1,2-Dichlorobenzene	ND	1.0
106-46-7	1,4-Dichlorobenzene	ND	1.0
110-57-6	trans-1,4-Dichloro-2-butene	ND	2.0
75-71-8	Dichlorodifluoromethane	ND	1.0
75-34-3	1,1-Dichloroethane	ND	1.0
107-06-2	1,2-Dichloroethane	ND	1.0
75-35-4	1,1-Dichloroethene	ND	1.0
156-59-2	cis-1,2-Dichloroethene	ND	1.0
156-60-5	trans-1,2-Dichloroethene	ND	1.0
78-87-5	1,2-Dichloropropane	ND	1.0
10061-01-5	cis-1,3-Dichloropropene	ND	1.0
10061-02-6	trans-1,3-Dichloropropene	ND	1.0
100-41-4	Ethylbenzene	ND	1.0
591-78-6	2-Hexanone	ND	20
74-88-4	Iodomethane	ND	1.0
78-93-3	Methyl ethyl ketone	ND	20
108-10-1	Methyl isobutyl ketone	ND	20
75-09-2	Methylene chloride	ND	1.0
100-42-5	Styrene	ND	1.0
630-20-6	1,1,1,2-Tetrachloroethane	ND	1.0
79-34-5	1,1,2,2-Tetrachloroethane	ND	1.0
127-18-4	Tetrachloroethene	ND	1.0
108-88-3	Toluene	ND	1.0
71-55-6	1,1,1-Trichloroethane	ND	1.0
79-00-5	1,1,2-Trichloroethane	ND	1.0
79-01-6	Trichloroethene	ND	1.0
75-69-4	Trichlorofluoromethane	ND	1.0
96-18-4	1,2,3-Trichloropropane	ND	1.0

QUALITY ASSURANCE REPORT FOR EPA METHOD 8260A: METHOD BLANK (Continued)

Sample ID: Quality Assurance Method Blank
Matrix: WATER

Date Reported: 07/05/99
Date Analyzed:

C.A.S. #	TARGET COMPOUNDS	CONCENTRATION ($\mu\text{g/L}$)	LIMIT OF QUANTITATION($\mu\text{g/L}$)
108-05-4	Vinyl acetate	ND	1.0
75-01-4	Vinyl chloride	ND	1.0
108383/106423	m+p-Xylenes	ND	1.0
95-47-6	o-Xylene	ND	1.0

ND= Indicates compound was analyzed for but not detected.

Runtime Quality Assurance Report

SYSTEM MONITORING COMPOUNDS	CONCENTRATION($\mu\text{g/L}$)		PERCENT	ACCEPTANCE
	ADDED	MEASURED	RECOVERY	RANGE
1,2-Dichloroethane d4	10	11.8	118	80-120
Toluene d8	10	10.4	104	80-120
p-Bromofluorobenzene	10	9.16	92	80-120

REPORT COMMENTS: None

Analyst: CS Reviewing Supervisor: nmj /chem/5971A.lva070199.b\jul011401014.d

QUALITY ASSURANCE REPORT FOR EPA METHOD 8260A: REFERENCE STANDARD BLANK MATRIX SPIKE

Sample ID: Quality Assurance Blank Matrix Spike
 Matrix: WATER
 Extract Method: EPA 5030

Date Reported: 07/05/99
 Date Analyzed: 6/29/99 10:55

SPIKE COMPOUNDS	CONCENTRATION(µg/L)		PERCENT	ACCEPTANCE
	ADDED	MEASURED	RECOVERY	
Acetone	50	43.9	88	60-140
Benzene	5.00	5.39	108	60-140
Bromochloromethane	5.00	5.85	117	60-140
Bromodichloromethane	5.00	4.91	98	60-140
Bromoform	5.00	5.08	102	60-140
Bromomethane	5.00	4.49	90	60-140
Carbon tetrachloride	5.00	5.53	111	60-140
Chlorobenzene	5.00	5.10	102	60-140
Chlorodibromomethane	5.00	4.93	99	60-140
Chloroethane	5.00	5.62	112	60-140
Chloroform	5.00	5.50	110	60-140
Chloromethane	5.00	5.88	118	60-140
1,2-Dibromo-3-chloropropane	5.00	4.30	86	60-140
1,2-Dibromoethane	5.00	4.87	97	60-140
Dibromomethane	5.00	5.08	102	60-140
1,2-Dichlorobenzene	5.00	4.71	94	60-140
1,4-Dichlorobenzene	5.00	4.90	98	60-140
Dichlorodifluoromethane	5.00	6.02	120	60-140
1,1-Dichloroethane	5.00	5.73	115	60-140
1,1-Dichloroethene	5.00	5.91	118	60-140
cis-1,2-Dichloroethene	5.00	5.55	111	60-140
trans-1,2-Dichloroethene	5.00	5.74	115	60-140
1,2-Dichloropropane	5.00	4.49	90	60-140
cis-1,3-Dichloropropene	5.00	5.37	107	60-140
trans-1,3-Dichloropropene	5.00	4.85	97	60-140
Ethylbenzene	5.00	5.19	104	60-140
2-Hexanone	50	45.3	91	60-140
Methyl ethyl ketone	50	44.7	89	60-140
Methyl isobutyl ketone	50	42.2	84	60-140
Methylene chloride	5.00	5.39	108	60-140
Styrene	5.00	5.10	102	60-140
1,1,1,2-Tetrachloroethane	5.00	5.13	103	60-140
1,1,2,2-Tetrachloroethane	5.00	4.26	85	60-140
Tetrachloroethene	5.00	5.75	115	60-140
Toluene	5.00	5.06	101	60-140
1,1,1-Trichloroethane	5.00	5.40	108	60-140
1,1,2-Trichloroethane	5.00	4.84	97	60-140
Trichloroethene	5.00	5.40	108	60-140
Trichlorofluoromethane	5.00	4.88	98	60-140
1,2,3-Trichloropropane	5.00	4.42	88	60-140
Vinyl chloride	5.00	5.37	107	60-140
m+p-Xylenes	10	10.6	106	60-140
o-Xylene	5.00	5.08	102	60-140

Runtime Quality Assurance Report

SYSTEM MONITORING COMPOUNDS	CONCENTRATION(µg/L)		PERCENT	ACCEPTANCE
	ADDED	MEASURED	RECOVERY	
1,2-Dichloroethane d4	10	10.3	103	80-120
Toluene d8	10	10.5	105	80-120
p-Bromofluorobenzene	10	9.63	96	80-120

REPORT COMMENTS: None

Analyst:  Reviewing Supervisor:  /chem/5971A.i/va062999.b/jun290301003.d

Date: 30-JUN-99Received by: Krystal McDonaldLogged In by: Krystal McDonald**SAMPLE CONDITION QA/QC REPORT**

This report provides information about the condition of the sample(s)
and associated sample custody information on receipt at the laboratory.

Chain of Custody Form
Completed & Signed

Yes Comments: _____

Chain of Custody Seal

No Comments: _____

Intact

N/A Comments: _____

Signature Match Chain of Custody vs. Seal

N/A Comments: _____

Samples Received Cold

Yes Comments: _____

Samples Received Within Holding Time

Yes Comments: _____

Samples Received in Proper Containers

Yes Comments: _____

Samples Received Properly Preserved

N/A Comments: _____

Samples requiring analysis for volatile organics are tested for proper preservation at the time of analysis.
Any preservation problems encountered for these samples are noted on the analytical parameter report pages.

Client notified about sample discrepancies:

Who: _____ By: _____ Date/Time: _____

Method of Shipping: Fed Ex

Additional comments: Received 1 broken vial for CHHL-9906-101.

CHAIN OF CUSTODY RECORD

Hydrometries, Inc.

H1014

2727 Airport Road • Helena, Montana 59601 • (406) 443-4150

PROJ. NO.		PROJECT NAME		NO. OF CON- TAINERS	Commons UF/RAW	Nutrients UF/H ₂ SO ₄	Diss. Metal F/HNO ₃	CN UF/NaOH	Total Metals UF/HNO ₃	Total Recoverable Metals UF/HNO ₃	BTEX	TPH	VOC's/HCP							REMARKS
SAMPLERS: (Signature)																				
DATE	TIME	COMP.	GRAB																	
6/28	1540		X	CHHL-9906-100	2								X							001-99-54235
6/28	1635		X	-101	2								X							002
6/28	1730		X	-102	2								X							003
Rush Analyses																			1 val for CHHL-9906-101	
																			was rec. broken. RM.	
																			Due	
																			09/02/99	
Relinquished (Signature)		Date/Time		Received by: (Signature)		Lab		P.O. #		Shipped via: Bus, Fed Ex, UPS										
Relinquished (Signature)		Date/Time		Received by: (Signature)		Remarks														
Relinquished (Signature)		Date/Time		Received for Laboratory by: (Signature)		Date/Time		Enclosed: ☒ Parameter sheet w/ detection limits		☐ QA/QC standard mixing instructions ☒ Cover letter ☐ Other										

HFORM-1-4/95

Return results & electronic copy to:
Computer Dept. at address at top of page

Split Samples:

☐ Accepted ☐ Declined

Signature



ENERGY LABORATORIES, INC.

P.O. BOX 30916 • 1120 SOUTH 27TH STREET • BILLINGS, MT 59107-0916 • PHONE (406) 252-6325
FAX (406) 252-6069 • 1-800-735-4489 • E-MAIL eli@energylab.com

Client: Hydrometrics
Date Sampled: 08-JUL-99 14:20
Date Received: 14-JUL-99
Analysis Date: 19-JUL-1999 18:21
Project Info: PROJ. #0054, CITY OF HELENA
Sample Info: CHL-9907-100

HL-99-2

Lab No.: 001-99-54704
Report Date: 07/23/99 13:55
Extraction Method: EPA 5030
Sample Matrix: WATER; pH= < 2

EPA METHOD 8260A: VOLATILE ORGANICS ANALYSIS REPORT

COMPOUNDS	CAS NO.	CONCENTRATION UNITS = ug/L (ppb)	RESULT	QUALIFIER
Acetone	67-64-1		<20	U
Acrylonitrile	107-13-1		<20	U
Benzene	71-43-2		<1.0	U
Bromochloromethane	74-97-5		<1.0	U
Bromodichloromethane	75-27-4		<1.0	U
Bromoform	75-25-2		<1.0	U
Bromomethane	74-83-9		<1.0	U
Carbon disulfide	75-15-0		<1.0	U
Carbon tetrachloride	56-23-5		<1.0	U
Chlorobenzene	108-90-7		<1.0	U
Chlorodibromomethane	124-48-1		<1.0	U
Chloroethane	75-00-3		<1.0	U
Chloroform	67-66-3		2.2	
Chloromethane	74-87-3		<1.0	U
1,2-Dibromo-3-chloropropane	96-12-8		<1.0	U
1,2-Dibromoethane	106-93-4		<1.0	U
Dibromomethane	74-95-3		<1.0	U
1,2-Dichlorobenzene	95-50-1		<1.0	U
1,4-Dichlorobenzene	106-46-7		<1.0	U
trans-1,4-Dichloro-2-butene	110-57-6		<2.0	U
Dichlorodifluoromethane	75-71-8		1.4	
1,1-Dichloroethane	75-34-3		1.6	
1,2-Dichloroethane	107-06-2		<1.0	U
1,1-Dichloroethene	75-35-4		<1.0	U
cis-1,2-Dichloroethene	156-59-2		<1.0	0.22J
trans-1,2-Dichloroethene	156-60-5		<1.0	U
1,2-Dichloropropane	78-87-5		<1.0	U
cis-1,3-Dichloropropene	10061-01-5		<1.0	U
trans-1,3-Dichloropropene	10061-02-6		<1.0	U
Ethylbenzene	100-41-4		<1.0	U
2-Hexanone	591-78-6		<20	U
Iodomethane	74-88-4		<1.0	U
Methyl ethyl ketone	78-93-3		<20	U
Methyl isobutyl ketone	108-10-1		<20	U
Methylene chloride	75-09-2		<1.0	0.82J
Styrene	100-42-5		<1.0	U
1,1,1,2-Tetrachloroethane	630-20-6		<1.0	U
1,1,2,2-Tetrachloroethane	79-34-5		<1.0	U
Tetrachloroethene	127-18-4		5.8	
Toluene	108-88-3		<1.0	U
1,1,1-Trichloroethane	71-55-6		1.2	
1,1,2-Trichloroethane	79-00-5		<1.0	U
Trichloroethene	79-01-6		<1.0	0.85J
Trichlorofluoromethane	75-69-4		<1.0	0.75J
1,2,3-Trichloropropane	96-18-4		<1.0	U
Vinyl acetate	108-05-4		<1.0	U
Vinyl chloride	75-01-4		<1.0	U
m+p-Xylenes	108383/106423		<1.0	U
o-Xylene	95-47-6		<1.0	U

SURROGATE RECOVERY REPORT

Surrogate Compound	Added-ug/L	Measured-ug/L	%Rec	QC Limits
1,2-Dichloroethane d4	10.0	10.4	104	80--120
Toluene d8	10.0	10.5	105	80--120
p-Bromofluorobenzene	10.0	10.6	106	80--120

QUALIFIER CODE EXPLANATIONS AND NOTES:

- U= Indicates compound was analyzed for but not detected.
- J= Estimated value. Present, but less than the limit of quantitation.

REPORT COMMENTS: None

Analyst: CS Reviewing Supervisor: mw /chem/5971A.1/va071999.b/jul191101011.d



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Client: Hydrometrics
Date Sampled: 09-JUL-99 12:46
Date Received: 14-JUL-99
Analysis Date: 19-JUL-1999 18:57
Project Info: PROJ. #0054, CITY OF HELENA
Sample Info: CHL-9907-101

HL-99-3

Lab No.: 002-99-54704
Report Date: 07/23/99 13:56
Extraction Method: EPA 5030
Sample Matrix: WATER; pH= < 2

EPA METHOD 8260A: VOLATILE ORGANICS ANALYSIS REPORT

CONCENTRATION UNITS = ug/L (ppb)			
COMPOUNDS	CAS NO.	RESULT	QUALIFIER
Acetone	67-64-1	<20	U
Acrylonitrile	107-13-1	<20	U
Benzene	71-43-2	<1.0	U
Bromochloromethane	74-97-5	<1.0	U
Bromodichloromethane	75-27-4	<1.0	U
Bromoform	75-25-2	<1.0	U
Bromomethane	74-83-9	<1.0	U
Carbon disulfide	75-15-0	<1.0	U
Carbon tetrachloride	56-23-5	<1.0	U
Chlorobenzene	108-90-7	<1.0	U
Chlorodibromomethane	124-48-1	<1.0	U
Chloroethane	75-00-3	<1.0	U
Chloroform	67-66-3	1.8	
Chloromethane	74-87-3	<1.0	U
1,2-Dibromo-3-chloropropane	96-12-8	<1.0	U
1,2-Dibromoethane	106-93-4	<1.0	U
Dibromomethane	74-95-3	<1.0	U
1,2-Dichlorobenzene	95-50-1	<1.0	U
1,4-Dichlorobenzene	106-46-7	<1.0	U
trans-1,4-Dichloro-2-butene	110-57-6	<2.0	U
Dichlorodifluoromethane	75-71-8	6.7	
1,1-Dichloroethane	75-34-3	5.2	
1,2-Dichloroethane	107-06-2	<1.0	U
1,1-Dichloroethene	75-35-4	<1.0	0.41J
cis-1,2-Dichloroethene	156-59-2	<1.0	0.38J
trans-1,2-Dichloroethene	156-60-5	<1.0	U
1,2-Dichloropropane	78-87-5	<1.0	U
cis-1,3-Dichloropropene	10061-01-5	<1.0	U
trans-1,3-Dichloropropene	10061-02-6	<1.0	U
Ethylbenzene	100-41-4	<1.0	U
2-Hexanone	591-78-6	<20	U
Iodomethane	74-88-4	<1.0	U
Methyl ethyl ketone	78-93-3	<20	U
Methyl isobutyl ketone	108-10-1	<20	U
Methylene chloride	75-09-2	6.6	
Styrene	100-42-5	<1.0	U
1,1,1,2-Tetrachloroethane	630-20-6	<1.0	U
1,1,2,2-Tetrachloroethane	79-34-5	<1.0	U
Tetrachloroethene	127-18-4	24	D
Toluene	108-88-3	<1.0	U
1,1,1-Trichloroethane	71-55-6	4.8	
1,1,2-Trichloroethane	79-00-5	<1.0	U
Trichloroethene	79-01-6	3.2	
Trichlorofluoromethane	75-69-4	4.4	
1,2,3-Trichloropropane	96-18-4	<1.0	U
Vinyl acetate	108-05-4	<1.0	U
Vinyl chloride	75-01-4	<1.0	U
m+p-Xylenes	108383/106423	<1.0	U
o-Xylene	95-47-6	<1.0	U

SURROGATE RECOVERY REPORT

Surrogate Compound	Added-ug/L	Measured-ug/L	%Rec	QC Limits
1,2-Dichloroethane d4	10.0	10.7	107	80--120
Toluene d8	10.0	10.3	103	80--120
p-Bromofluorobenzene	10.0	10.9	109	80--120

QUALIFIER CODE EXPLANATIONS AND NOTES:

- U= Indicates compound was analyzed for but not detected.
- D= Value derived from a 10 times dilution of the sample extract.
- J= Estimated value. Present, but less than the limit of quantitation.

REPORT COMMENTS: None

Analyst: a Reviewing Supervisor: MD /chem/5971a.i/va071999.b/jul191201012.d



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FAX (406) 252-6069 • 1-800-735-4489 • E-MAIL eli@energylab.comClient: Hydrometrics
Date Sampled: 12-JUL-99 14:52
Date Received: 14-JUL-99
Analysis Date: 19-JUL-1999 19:31
Project Info: PROJ. #0054, CITY OF HELENA
Sample Info: CHL-9907-102

HL-99-1

Lab No.: 003-99-54704
Report Date: 07/23/99 13:56
Extraction Method: EPA 5030
Sample Matrix: WATER; pH= < 2

EPA METHOD 8260A: VOLATILE ORGANICS ANALYSIS REPORT

COMPOUNDS	CONCENTRATION UNITS = ug/L (ppb)		QUALIFIER
	CAS NO.	RESULT	
Acetone	67-64-1	<20	U
Acrylonitrile	107-13-1	<20	U
Benzene	71-43-2	<1.0	U
Bromochloromethane	74-97-5	<1.0	U
Bromodichloromethane	75-27-4	<1.0	U
Bromoform	75-25-2	<1.0	U
Bromomethane	74-83-9	<1.0	U
Carbon disulfide	75-15-0	<1.0	U
Carbon tetrachloride	56-23-5	<1.0	U
Chlorobenzene	108-90-7	<1.0	U
Chlorodibromomethane	124-48-1	<1.0	U
Chloroethane	75-00-3	<1.0	U
Chloroform	67-66-3	2.5	
Chloromethane	74-87-3	<1.0	U
1,2-Dibromo-3-chloropropane	96-12-8	<1.0	U
1,2-Dibromoethane	106-93-4	<1.0	U
Dibromomethane	74-95-3	<1.0	U
1,2-Dichlorobenzene	95-50-1	<1.0	U
1,4-Dichlorobenzene	106-46-7	<1.0	U
trans-1,4-Dichloro-2-butene	110-57-6	<2.0	U
Dichlorodifluoromethane	75-71-8	1.2	
1,1-Dichloroethane	75-34-3	1.3	
1,2-Dichloroethane	107-06-2	<1.0	U
1,1-Dichloroethene	75-35-4	<1.0	U
cis-1,2-Dichloroethene	156-59-2	1.1	
trans-1,2-Dichloroethene	156-60-5	<1.0	U
1,2-Dichloropropane	78-87-5	<1.0	U
cis-1,3-Dichloropropene	10061-01-5	<1.0	U
trans-1,3-Dichloropropene	10061-02-6	<1.0	U
Ethylbenzene	100-41-4	<1.0	U
2-Hexanone	591-78-6	<20	U
Iodomethane	74-88-4	<1.0	U
Methyl ethyl ketone	78-93-3	<20	U
Methyl isobutyl ketone	108-10-1	<20	U
Methylene chloride	75-09-2	<1.0	U
Styrene	100-42-5	<1.0	U
1,1,1,2-Tetrachloroethane	630-20-6	<1.0	U
1,1,2,2-Tetrachloroethane	79-34-5	<1.0	U
Tetrachloroethene	127-18-4	7.8	
Toluene	108-88-3	<1.0	U
1,1,1-Trichloroethane	71-55-6	<1.0	0.83J
1,1,2-Trichloroethane	79-00-5	<1.0	U
Trichloroethene	79-01-6	1.0	
Trichlorofluoromethane	75-69-4	<1.0	0.46J
1,2,3-Trichloropropane	96-18-4	<1.0	U
Vinyl acetate	108-05-4	<1.0	U
Vinyl chloride	75-01-4	<1.0	U
m+p-Xylenes	108383/106423	<1.0	U
o-Xylene	95-47-6	<1.0	U

SURROGATE RECOVERY REPORT				
Surrogate Compound	Added-ug/L	Measured-ug/L	%Rec	QC Limits
1,2-Dichloroethane d4	10.0	10.6	106	80--120
Toluene d8	10.0	10.6	106	80--120
p-Bromofluorobenzene	10.0	10.3	103	80--120

QUALIFIER CODE EXPLANATIONS AND NOTES:

U= Indicates compound was analyzed for but not detected.

J= Estimated value. Present, but less than the limit of quantitation.

REPORT COMMENTS: None

Analyst: 2 Reviewing Supervisor: WJ /chem/5971A.i/va071999.b/jul191301013.d

EPA METHOD 8260A: QUALITY ASSURANCE MATRIX SPIKE REPORT

Quality Control Sample: Matrix Spike Analysis 22-JUL-1999 14:51

Lab No.: 001-99-54704ms

Report Date: 07/23/99 13:47

Extraction Method: EPA 5030

Sample Matrix: WATER

File: /chem/5971A.i/va072299.b/jul221101011.d

Remarks: These compounds were spiked into the sample matrix to determine if the sample matrix contributes bias to the analytical results and to monitor the accuracy of the methodology.

Spike Compound	CONCENTRATION UNITS = ug/L (ppb)				
	Spike Added	Sample Concentration	Matrix Spike Concentration	MS %Rec	QC Limits
=====	=====	=====	=====	=====	=====
Benzene	10.0	<1.00	11.2	112	60--140
Chlorobenzene	10.0	<1.00	11.0	110	60--140
1,1-Dichloroethene	10.0	<1.00	11.8	118	60--140
Toluene	10.0	<1.00	10.8	108	60--140
Trichloroethene	10.0	<1.00	12.6	126	60--140

SURROGATE RECOVERY REPORT

Surrogate Compound	Added-ug/L	Measured-ug/L	%Rec	QC Limits
1,2-Dichloroethane d4	20.0	21.6	108	80--120
Toluene d8	20.0	20.4	102	80--120
p-Bromofluorobenzene	20.0	21.2	106	80--120

EPA METHOD 8260A: QUALITY ASSURANCE MATRIX SPIKE DUPLICATE REPORT

Quality Control Sample: Matrix Spike Duplicate Analysis 22-JUL-1999 15:27

Lab No.: 001-99-54704msd

File: /chem/5971A.i/va072299.b/jul221201012.d

Remarks: These compounds were again spiked into the sample matrix to determine if the sample matrix contributes bias to the analytical results and to monitor the accuracy and precision of the methodology.

Spike Compound	CONCENTRATION UNITS = ug/L (ppb)					---QC Limits---	
	Spike Added	Matrix Spike Dup. Conc.	MSD %Rec	%RPD	RPD	Rec	
=====	=====	=====	=====	=====	=====	=====	=====
Benzene	10.0	11.3	113	1	11	60--140	
Chlorobenzene	10.0	10.7	107	3	13	60--140	
1,1-Dichloroethene	10.0	11.8	118	0	14	60--140	
Toluene	10.0	10.8	108	0	13	60--140	
Trichloroethene	10.0	12.5	125	1	14	60--140	

SURROGATE RECOVERY REPORT

Surrogate Compound	Added-ug/L	Measured-ug/L	%Rec	QC Limits
1,2-Dichloroethane d4	20.0	21.3	106	80--120
Toluene d8	20.0	20.4	102	80--120
p-Bromofluorobenzene	20.0	21.2	106	80--120

REPORT COMMENTS: The sample was diluted by 2 times before spiking.

Analyst: S Reviewing Supervisor: un

EPA METHOD 8260A: QUALITY ASSURANCE BLANK MATRIX SPIKE REPORT

Quality Control Sample: Reference Sample Analysis 19-JUL-1999 11:29

Report Date: 07/23/99 13:58

Extraction Method: EPA 5030

Sample Matrix: WATER

File: /chem/5971A.i/va071999.b/jul190301003.d

Remarks: This reference sample was spiked into a blank sample matrix then extracted and analyzed with your set of samples to determine if the methodology is in control and to monitor the laboratory's ability to produce accurate results.

Spike Compound	CONCENTRATION UNITS = ug/L (ppb)			
	Added	Measured	%Rec	QC Limits
=====	=====	=====	=====	=====
Acetone	50.0	45.4	91	60--140
Benzene	5.00	4.86	97	60--140
Bromochloromethane	5.00	4.74	95	60--140
Bromodichloromethane	5.00	5.01	100	60--140
Bromoform	5.00	4.85	97	60--140
Bromomethane	5.00	4.87	97	60--140
Carbon tetrachloride	5.00	4.96	99	60--140
Chlorobenzene	5.00	5.06	101	60--140
Chlorodibromomethane	5.00	4.84	97	60--140
Chloroethane	5.00	5.04	101	60--140
Chloroform	5.00	4.68	94	60--140
Chloromethane	5.00	5.81	116	60--140
1,2-Dibromo-3-chloropropane	5.00	4.48	90	60--140
1,2-Dibromoethane	5.00	4.97	99	60--140
Dibromomethane	5.00	5.08	102	60--140
1,2-Dichlorobenzene	5.00	4.34	87	60--140
1,4-Dichlorobenzene	5.00	4.93	99	60--140
Dichlorodifluoromethane	5.00	5.10	102	60--140
1,1-Dichloroethane	5.00	4.86	97	60--140
1,1-Dichloroethene	5.00	5.02	100	60--140
cis-1,2-Dichloroethene	5.00	4.72	94	60--140
trans-1,2-Dichloroethene	5.00	4.99	100	60--140
1,2-Dichloropropane	5.00	5.05	101	60--140
cis-1,3-Dichloropropene	5.00	5.73	115	60--140
trans-1,3-Dichloropropene	5.00	4.88	98	60--140
Ethylbenzene	5.00	5.27	105	60--140
2-Hexanone	50.0	48.3	97	60--140
Methyl ethyl ketone	50.0	47.0	94	60--140
Methyl isobutyl ketone	50.0	51.2	102	60--140
Methylene chloride	5.00	4.66	93	60--140
Styrene	5.00	5.02	100	60--140
1,1,1,2-Tetrachloroethane	5.00	4.93	99	60--140
1,1,2,2-Tetrachloroethane	5.00	4.75	95	60--140
Tetrachloroethene	5.00	5.02	100	60--140
Toluene	5.00	5.09	102	60--140
1,1,1-Trichloroethane	5.00	4.70	94	60--140
1,1,2-Trichloroethane	5.00	4.96	99	60--140
Trichloroethene	5.00	5.28	106	60--140
Trichlorofluoromethane	5.00	4.29	86	60--140
1,2,3-Trichloropropane	5.00	4.92	98	60--140
Vinyl chloride	5.00	4.72	94	60--140
m+p-Xylenes	10.0	10.4	104	60--140
o-Xylene	5.00	5.08	102	60--140

SURROGATE RECOVERY REPORT

Surrogate Compound	Added-ug/L	Measured-ug/L	%Rec	QC Limits
1,2-Dichloroethane d4	10.0	9.18	92	80--120
Toluene d8	10.0	10.7	107	80--120
p-Bromofluorobenzene	10.0	10.8	108	80--120

REPORT COMMENTS: None

Analyst: C Reviewing Supervisor: WJ

Quality Control Sample: Laboratory Reagent Blank 19-JUL-1999 12:39

Report Date: 07/23/99 14:03

Extraction Method: EPA 5030

Sample Matrix: WATER

Remarks: This Laboratory Reagent Blank Quality Control Sample was extracted and analyzed with your set of samples to determine if method analytes or other interferences are present in the laboratory environment, the reagents, or the apparatus.

EPA METHOD 8260A: VOLATILE ORGANICS ANALYSIS REPORT

COMPOUNDS	CONCENTRATION UNITS = ug/L (ppb)		QUALIFIER
	CAS NO.	RESULT	
Acetone	67-64-1	<20	U
Acrylonitrile	107-13-1	<20	U
Benzene	71-43-2	<1.0	U
Bromochloromethane	74-97-5	<1.0	U
Bromodichloromethane	75-27-4	<1.0	U
Bromoform	75-25-2	<1.0	U
Bromomethane	74-83-9	<1.0	U
Carbon disulfide	75-15-0	<1.0	U
Carbon tetrachloride	56-23-5	<1.0	U
Chlorobenzene	108-90-7	<1.0	U
Chlorodibromomethane	124-48-1	<1.0	U
Chloroethane	75-00-3	<1.0	U
Chloroform	67-66-3	<1.0	U
Chloromethane	74-87-3	<1.0	U
1,2-Dibromo-3-chloropropane	96-12-8	<1.0	U
1,2-Dibromoethane	106-93-4	<1.0	U
Dibromomethane	74-95-3	<1.0	U
1,2-Dichlorobenzene	95-50-1	<1.0	U
1,4-Dichlorobenzene	106-46-7	<1.0	U
trans-1,4-Dichloro-2-butene	110-57-6	<2.0	U
Dichlorodifluoromethane	75-71-8	<1.0	U
1,1-Dichloroethane	75-34-3	<1.0	U
1,2-Dichloroethane	107-06-2	<1.0	U
1,1-Dichloroethene	75-35-4	<1.0	U
cis-1,2-Dichloroethene	156-59-2	<1.0	U
trans-1,2-Dichloroethene	156-60-5	<1.0	U
1,2-Dichloropropane	78-87-5	<1.0	U
cis-1,3-Dichloropropene	10061-01-5	<1.0	U
trans-1,3-Dichloropropene	10061-02-6	<1.0	U
Ethylbenzene	100-41-4	<1.0	U
2-Hexanone	591-78-6	<20	U
Iodomethane	74-88-4	<1.0	U
Methyl ethyl ketone	78-93-3	<20	U
Methyl isobutyl ketone	108-10-1	<20	U
Methylene chloride	75-09-2	<1.0	U
Styrene	100-42-5	<1.0	U
1,1,1,2-Tetrachloroethane	630-20-6	<1.0	U
1,1,2,2-Tetrachloroethane	79-34-5	<1.0	U
Tetrachloroethene	127-18-4	<1.0	U
Toluene	108-88-3	<1.0	U
1,1,1-Trichloroethane	71-55-6	<1.0	U
1,1,2-Trichloroethane	79-00-5	<1.0	U
Trichloroethene	79-01-6	<1.0	U
Trichlorofluoromethane	75-69-4	<1.0	U
1,2,3-Trichloropropane	96-18-4	<1.0	U
Vinyl acetate	108-05-4	<1.0	U
Vinyl chloride	75-01-4	<1.0	U
m+p-Xylenes	108383/106423	<1.0	U
o-Xylene	95-47-6	<1.0	U

SURROGATE RECOVERY REPORT

Surrogate Compound	Added-ug/L	Measured-ug/L	%Rec	QC Limits
1,2-Dichloroethane d4	10.0	9.75	98	80--120
Toluene d8	10.0	10.3	103	80--120
p-Bromofluorobenzene	10.0	11.0	110	80--120

QUALIFIER CODE EXPLANATIONS AND NOTES:

U- Indicates compound was analyzed for but not detected.

REPORT COMMENTS: None

Analyst: Reviewing Supervisor: /chem/5971A.i/va071999.b/jul190501005.d

Date: 14-JUL-99Received by: Randa HoelscherLogged In by: Randa Hoelscher**SAMPLE CONDITION QA/QC REPORT**

This report provides information about the condition of the sample(s)
and associated sample custody information on receipt at the laboratory.

Chain of Custody Form
Completed & Signed

Yes Comments: _____

Chain of Custody Seal

Yes Comments: _____

Intact

Yes Comments: _____

Signature Match Chain of Custody vs. Seal

Yes Comments: _____

Samples Received Cold

No Comments: _____

Samples Received Within Holding Time

Yes Comments: _____

Samples Received in Proper Containers

Yes Comments: _____

Samples Received Properly Preserved

N/A Comments: _____

**Samples requiring analysis for volatile organics are tested for proper preservation at the time of analysis.
Any preservation problems encountered for these samples are noted on the analytical parameter report pages.**

Client notified about sample discrepancies:

Who: _____ By: _____ Date/Time: _____

Method of Shipping: UPS Ground

Additional comments: pc: Jodi Bingham, Hydrometrics, Helena

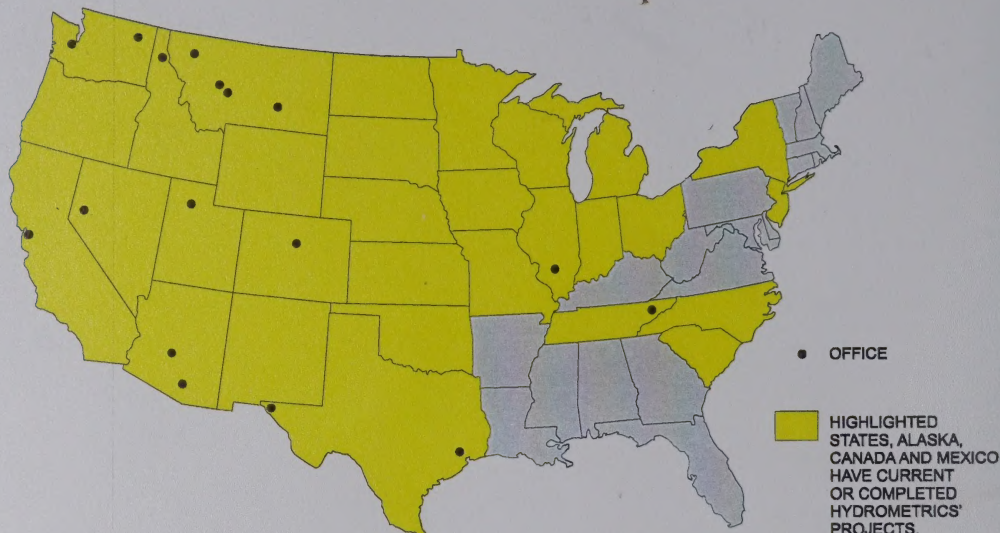
Hydrometries, Inc.

CHAIN OF CUSTODY RECORD

2727 Airport Road • Helena, Montana 59601 • (406) 443-4150

4014H / Ws / Seal

PROJ. NO.		PROJECT NAME		NO. OF CON- TAINERS	ANALYSIS PARAMETERS												REMARKS			
SAMPLERS: (Signature)					Commons UF/RAW	Nutrients UF/H ₂ SO ₄	Diss. Metal F/HNO ₃	CN UF/HNO ₃	Total Metals UF/HNO ₃	Total Recoverable Metals UF/HNO ₃	BTEX	TPH	VOC							
DATE	TIME	COMP.	GRAB		SAMPLE NUMBER															
7/6/99	1420		✓	CAL-9907-100	2								✓					001-99-54704		
7/6/99	1246		✓	CHL-9907-101	2								✓					002		
7/6/99	1452		✓	CHL-9907-102	2								✓					003		
Relinquished (Signature)		Date/Time		Received by: (Signature)		Lab		P.O. #		Shipped via: Bus, Fed Ex, UPS										
<i>[Signature]</i>		7/13/99 0800				Energy		H09271		Other: <u>Hand Carried</u>										
Relinquished (Signature)		Date/Time		Received by: (Signature)		Remarks														
Relinquished (Signature)		Date/Time		Received for Laboratory by: (Signature)		Date/Time		Enclosed: ☒ Parameter sheet w/detection limits												
				<i>Linda Hoelscher</i>		07/14/99 1040		☐ QA/QC standard mixing instructions ☒ Cover letter ☐ Other												
Split Samples: ☐ Accepted ☐ Declined _____ Signature																				



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